Rivew of Applied Mycology

1926

Vol. V

described species of this genus, have been studied in pure culture. Solid agars, liquid media, and M/100 solutions of a number of sugars, amino acids, nitrates, sulphates, phosphates, chlorides, and of potassium carbonate were used under controlled conditions to obtain certain specific reactions.

On the basis primarily of their physiological reactions in culture the following species are differentiated: *P. infestans*; *P. infestans* var. *phaseoli* (*P. phaseoli* Thaxter); No. 26; No. 116; *P. omnivora* (including 24 species and strains from various parts of the world previously known under the names of *P. colocasiae, P. palmivora, P. faberi, P. parasitica*, Reddick's *Phytophthora* [a strain of *P. parasitica*, the host of which is not given], and *P. parasitica* var. *rhei*); *P. pini* n. sp. (a weak parasite on the roots of *Pinus resinosa* in Minnesota, an English diagnosis of which is given); *P. cactorum* (including *P. fagi*); *P. cinnamomi*; *P. cryptogea*; No. 121; *P. erythroseptica*; *P. mexicana*; *P. nicotianae*; No. 8; No. 130; *P. capsici*; *P. citrophthora* (transferred from *Pythiacystis*); *P. arecae*; and *P. syringae*.

A key to all these species is given, based on their physiological reactions in culture, but it is stated that the inclusion of Nos. 121, 8, 130, 26, and 116 in this key does not signify that they are necessarily definite species, but that they can be readily separated from the other organisms and from one another.

The author is of opinion that the size and shape of the fruiting bodies (sporangia, oogonia, antheridia, and oospores) are minor characters which should only have a secondary place in the classification of the genus. He considers that the average of the morphological, pathological, and physiological characters should constitute the sphere of a species.

The saltation phenomenon in *Phytophthora* has been studied in detail, and it is concluded that no new species or varieties have been produced by saltation, and that, while the rate and type of colony growth, the shape and size of sporangia, and the presence or absence of oogonia are greatly influenced by saltation, these characteristics are too unstable and reversible to be given primary specific importance.

BLUMER (S.). **Infektionsversuche mit Erysiphaceen.** [Inoculation experiments with Erysiphaceae.]—*Centralbl. für Bakt.*, Ab. 2, lxv, 1–5, pp. 62–70, 1925.

In continuation of his previous researches on specialization in the Erysiphaceae [see this *Review*, ii, p. 180], the writer carried out a number of experiments [the technique of which is briefly described] in 1923 and 1924 with the oidial stages of *Erysiphe polygoni*, *Microsphaera baumleri*, and *M. astragali*.

The results of the tests [details of which are given] indicated that *E. polygoni*, like *E. graminis* and *E. cichoracearum*, consists of a number of biologically, and possibly also morphologically, distinct forms. As in the case of *E. horridula*, however [loc. cit.], the specialization of *E. polygoni* is not sharply defined, and primary and secondary hosts can be distinguished. The infection of the latter probably depends on the accidental combination of various physiological factors and not on a definite hereditary reaction.

The actual number of biologic forms of *E. polygoni* on the Papilionaceae has not yet been determined, but it seems probable that the forms of *Oidium* on *Pisum*, *Lathyrus*, and *Trifolium* are biologically distinct, though the two latter have a common host in *L. vernus*. Contrary to Salmon's findings (*Mem. Torrey Bot. Club*, ix, 1900), the *Oidium* on *T. medium* was found to differ little from that on *T. pratense*. *T. hybridum* and *T. pratense* are attacked by both forms. These results may be explained by the assumption that the *Trifolium* mildew comprises only one biologic form to which the individual species show varying degrees of susceptibility. On this basis, *T. pratense*, *T. hybridum*, *L. vernus*, and possibly *Melilotus officinalis* are susceptible; *T. ambiguum*, *T. montanum*, *T. fragiferum*, *T. ochroleucum*, and *T. trichocephalum* are tolerant; and *T. repens*, *T. badium*, *T. arvense*, *T. rubens*, and *T. subterraneum* are resistant.

Microsphaera bäumleri on *Vicia sylvatica* was found to differ so widely from the type of *E. polygoni* that it is regarded as a distinct species. *M. astragali* infected several species of *Astragalus* but not others, nor a large number of other Papilionaceae tested.

Neger's view that the parasitism of the Erysiphaceae represents a kind of tolerated symbiosis [see this *Review*, iii, p. 159] is rejected as being in conflict with observed facts.

FISCHER (E.). **Mykologische Beiträge. 31. Der Wirtswechsel der Sclerotinia rhododendri nebst Bemerkungen zur Frage der Entstehung der Heteroecie.** [Mycological contributions. 31. The alternative host of *Sclerotinia rhododendri* with observations on the origin of heteroecism.]—Reprinted from *Mitt. Naturforsch. Gesellsch. Bern*, *1925*, iv, 14 pp., 4 figs., 1925.

Ascospores of *Sclerotinia rhododendri*, the causal organism of a disease of the Alpine rose [*Rhododendron* spp.], were inoculated in the spring of 1925 into *Vaccinium myrtillus*, on which, about a month later, the characteristic conidial stage, with disjunctors, was observed. The spores of this fungus differed from those of *S. baccarum*, which also occurs on *V. myrtillus*, in their smaller dimensions (10 to 14 by 8 to 9 μ compared with a length of 19 to 23 μ and an almost equal diameter), as well as from *S. heteroica* (17 to 22 by 10 to 17 μ) which forms its sclerotial stage on *Ledum palustre* and its conidia on *V. uliginosum*.

TUNSTALL (A. C.). **Some observations on stem diseases in Cachar.**—*Quart. Journ. Indian Tea Assoc.*, *1925*, i, pp. 37–44, 1 pl., 1925.

Stem diseases of tea are stated to have spread considerably in the Surma Valley [north-eastern India], as the result of three successive droughts. The following fungi have been observed associated with these diseases, a brief description of each being given, together with general directions for their control.

The 'Jew's ear' fungus (*Auricularia auricula-judae*) is one of the commonest causes of infection, especially on large snags. The fungus spreads from the dead wood downwards, causing subsequent rotting of the living wood and cracking of the bark. Soft gelatinous brackets form during the rainy season.

Nectria cinnabarina is also very common, but is usually found to commence its attacks on the smaller twigs, spreading later to the larger branches and causing either a die-back or a canker.

Marasmius pulcher causes a die-back of the smaller branches. It resembles the common Indian thread blight [see this *Review*, iv, p. 67] in appearance, but does not seem to damage the leaves as much as the latter. The horse-hair blight (*M. equicrinis*) is common on bushes attacked by other stem diseases, and is usually confined to the dead bark, although it has occasionally been seen penetrating living stems.

Poria hypobrunnea is one of the commonest causes of dying back from dead snags, and sometimes extends down to the roots.

A new stem disease has recently been observed more frequently in this district than any of those mentioned above. It is caused by a fungus which attacks the woody stems and may kill the bark on the whole side of a branch. The dead bark does not fall off, but the surrounding healthy tissues produce a callus round the edges which in some cases completely covers the diseased portion. This does not, however, hinder the growth of the fungus, and the latter comes to the surface again lower down than in the earlier attack. The general appearance, as shown in the plate, is that of a long wound bounded by thick edges of callus. The symptoms closely resemble those associated with *Macrophoma theicola* and certain other fungi, but the fructifications of the parasite are quite distinctive. They form large numbers of black specks embedded in the dead bark. This fungus is apparently capable of attacking woody stems which have been weakened by other causes, quite apart from the presence of wounds on dead snags. It is still under investigation.

Two species of *Corticium* were found on tea stems in this district and it is mentioned that there appear to be five species of this genus attacking tea in north-eastern India, one of which resembles the cause of the well-known pink disease [*C. salmonicolor*]. Their study has not yet been completed. None of them appears to be fatal, but they have a decidedly weakening effect on the branches.

A white stem blight resembling a *Corticium* has also been reported. This is confined to the outer layers of the branch tissues, and has only a weakening effect on the growth of the bush.

Cankered growths on new shoots, following attacks of mosquito blight [*Helopeltis theivora*], are frequently observed. These growths may have no association with any parasitic organism, but the cankered branch is usually liable to attacks of red rust [*Cephaleuros parasitica*], grey blight (*Pestalozzia theae*), and other fungi. Cutting back cankered stems to about 8 inches is advised.

Attention is drawn to the influence of unsuitable conditions for the growth of the host on the prevalence of stem diseases, the variety of fungi found being thought to indicate that their attacks are largely secondary to such conditions. The drought has undoubtedly had an influence in predisposing to attack. The importance of proper aeration and cultivation of the soil is emphasized, and also the necessity for careful pruning of new shoots in order to permit a regular succession of new growth from the collar and thus replace

any old diseased shoots. The system commonly adopted, of cutting straight across the tops of bushes, is considered to be unsound.

Spraying with lime-sulphur has been found successful in the general control of stem diseases caused by external parasites. Treatment by cutting out diseased branches and painting pruning cuts and other wounds with Burgundy paste (made by dissolving 4 lb. copper sulphate in one gallon of water, dissolving 4 or 2 lb. washing soda in one gallon of water, and mixing the two solutions together when cold) is recommended.

TISDALE (W. B.). **Report of the Tobacco Experiment Station.**—*Rept. Florida Agric. Exper. Stat. for the fiscal year ending June 30, 1924*, pp. 121 R–129 R, 7 figs., 1924. [Received October, 1925.]

Laboratory studies in connexion with the black shank tobacco parasite (*Phytophthora nicotianae*) [see this *Review*, iv, p. 641] included the relation of temperature and reaction to its rate of growth on culture media and the relation of the parasite to its host. The fungus was found to make the best growth on neutral or slightly acid media at temperatures ranging from 10° to 35° C., with an optimum at 30°. All the root, stem, and leaf tissues are invaded, young plants being most rapidly infected, though older ones are also liable to attack. Only four of the 54 selections made from the strains most resistant to this disease tested in 1922–23 showed any improvement over previous trials. Five varieties of light or flue-cured tobacco were found to be highly susceptible. Black shank developed in many new localities of Gadsden County during the year, the total loss in the county, including that due to early topping and harvesting necessitated by the disease, being estimated at 20 per cent. of the crop.

Two selections of the F_2 generation of Big Cuba tobacco showed marked resistance to root rot (*Thielavia basicola*) [see this *Review*, iv, p. 572] but were susceptible to black shank. Conversely, the selections most resistant to black shank are susceptible to root rot.

Wildfire (*Bacterium tabacum*) was well controlled by the selection of new land for seed-beds or thorough steam sterilization of the old infected beds and covering material; seed disinfection; and spraying seedlings with Bordeaux mixture until ready for transplanting. Several beds in which these precautions were omitted developed the disease. The further spread of wildfire was checked in one bed after the occurrence of infection by heavy and frequent applications of Bordeaux dust, but the disease developed on the plants when they were set out in the field. There is stated to be no evidence that *Bact. tabacum* overwinters in the field in a degree sufficient to produce infection after transplanting. Cowpeas [*Vigna sinensis*] were found infected with wildfire in a field adjacent to diseased tobacco. Typical wildfire infection was produced on tobacco seedlings by spraying a water suspension of the organism, isolated from cowpeas, on the leaves.

Blackfire [*Bact. angulatum*] was more prevalent than in the previous year, attacking the sand and first middle leaves of Big Cuba tobacco grown in the open.

Other diseases observed during the year included a *Fusarium* wilt similar to that described by Johnson [*F. oxysporum* var. *nicotianae*: see this *Review*, i, p. 321], and a new fungous disease known as scab, believed to be caused by a species of *Cladosporium*. This affection is characterized in the early stages by irregular, olivaceous blotches on the upper surface of leaves and stems, and later by yellow discoloration of the foliage and soft rot of the petioles and stems during rainy periods. Fifty per cent. of a flat of seedlings were killed in ten days in the greenhouse by inoculation with a water suspension of the *Cladosporium* spores.

TOLLENAAR (D.). **Omzetting van Koolhydraten in het blad van Nicotiana tabacum L.** [The carbohydrate metabolism in the leaf of *Nicotiana tabacum* L.]—Proefschrift, 142 pp., 9 figs., Wageningen, 1925. [German summary: Abs. in *Bot. Centralbl.*, N.F., vi, 3–4, pp. 79–81, 1925.]

This exhaustive investigation on the carbohydrate metabolism of the leaves of *Nicotiana tabacum* contains the following reference of phytopathological interest. There are stated to be only two possible explanations of the starch accumulations found in the leaves of tobacco plants affected by mosaic and other virus diseases. Either the virus influences the starch-sugar ratio in a synthetic direction, or it inhibits transpiration and consequently interferes with the disintegration of the starch. The former hypothesis is shown to be correct.

ESMARCH (F.). **Pilzkrankheiten an Tomaten.** [Fungous diseases of Tomatoes.]—*Die Kranke Pflanze*, ii, 7, p. 149, 1925.

A brief account is given of the principal tomato diseases occurring in the Lössnitz district of Saxony, namely, stem rot (*Didymella lycopersici*); late blight (*Phytophthora infestans*); leaf spot (*Septoria lycopersici*); and leaf mould (*Cladosporium fuscum*) [*C. fulvum*: see next abstract]. Of these the first-named is stated to be the most destructive. Control measures against it should include the immediate removal and burning of all infected material and the application of 2 per cent. Bordeaux mixture to the plants not yet attacked. The other diseases mentioned may be controlled by timely applications of 1 per cent. Bordeaux mixture and thorough sanitation.

HASPER (E.). **Biologie und Bekämpfung des Cladosporium fulvum Cooke auf Solanum lycopersicum.** [Biology and control of *Cladosporium fulvum* Cooke on *Solanum lycopersicum*.]—*Zeitschr. für Pflanzenkrankh.*, xxxv, 3–4, pp. 112–118, 1925.

The symptoms of leaf mould (*Cladosporium fulvum*) [see this *Review*, iv, p. 195] on greenhouse tomatoes are briefly described. The purple coloration assumed under certain conditions by the brown conidial layers on the under side of the leaves is attributed to alkalinity of the substratum, the normal brown tinge being restored by the presence of acids. Inoculation experiments with purple conidia have constantly resulted in the production of a brown mycelium. Savelli's supposed variety '*violaceum*' (*Ann. R*

Acc. Agric. Torino, lvi, p. 63, 1913) is probably explicable on the basis of such a modification.

The mycelium of *C. fulvum* develops intercellularly and the conidiophores, which bear their conidia on lateral protuberances, emerge from the stomata on both sides of the leaf, chiefly the under side. The strikingly polymorphic, one to four-septate conidia average 12 to 27 by 6 to 9 μ. Ellipsoid forms predominate, but oval, pyriform, and spherical conidia also occur. The apex is rounded, sometimes bent, and the base frequently somewhat constricted. The conidia are hyaline when young, later brown, with a membrane which is highly resistant to the influence of chemicals and temperature.

The organism was readily cultivated. Germination by one or two germ-tubes occurred in $3\frac{1}{2}$ hours under favourable conditions. The optimum temperature for germination was found to be 20° to 26·5°, maximum 31° to 33°, and minimum 0° to 1° C.

Inoculation experiments were carried out on the Triumph, Comet, Sunrise, and Lucullus varieties, for all of which the incubation period at the optimum temperature was 10 to 14 days. The germ-tubes penetrated the interior of the leaf solely through the stomata. Outdoor inoculation tests gave negative results, germination apparently being inhibited by the drought and high temperature.

The conidia proved extremely resistant to desiccation, a high percentage germinating after eight, and a small proportion after ten months under air-dry conditions. Experiments showed that the conidia are also capable of surviving both very low (−13·2° C. but not −16·7° in ice for a week) and very high temperatures (50° to 60° in water, or 69° to 70° dry, for 3 hours). It is evident that they are quite able to carry over the disease from one year to the next, and the absence of the fungus in the field is thought to be due to the inability of the germ-tubes to live without water.

All the copper and sulphur preparations tested gave some control of the disease, but better results were given by 0·5 per cent. uspulun. The most promising means of control, however, are probably those indicated by the biology of the parasite, namely, a reduction of atmospheric humidity by thorough ventilation; the destruction of all infected material after the harvest; the rotation of tomatoes (on which *C. fulvum* is strictly specialized) with other crops; disinfection of the greenhouse with a 10 per cent. phenol solution; and sterilization of the soil with boiling water or steam.

Brown (Nellie A.). **A new bacterial disease of Tomato fruits.**—*Science*, N.S., lxii, 1592, pp. 12–13, 1925.

A serious disease of tomatoes was reported in June 1924 from Texas, and in the following August and September from Nebraska. Green fruits ready for shipping showed an inconspicuous, brown spot or a dark ring around and under the stalk. On examination at their destination the affected fruits showed a hard, brown centre, sometimes decayed from the darkened stem-end to the blossom-end, while in other cases the rot developed obliquely and involved a portion of the seeds. There was no exudation.

Bacteria occurred in large numbers in the tissues. The same organism was isolated from both the Texas and Nebraska material,

and greenhouse inoculations of wounded and unwounded green and ripening fruits resulted in the exact reproduction of the field symptoms.

Infection occurs mostly at the juncture between the stem and the tough cuticle of the fruit. Secondary infection and soft rot may occasionally be associated with the entrance of fungi and of other bacteria. The leaves and stems appear to be unaffected and inoculations on those parts have given negative results.

The causal organism of this disease is stated to be a yellow, polar-flagellate species, the biology of which is under investigation.

Weisse (A.). **Neue Beobachtungen über die Blattkrankheiten der Platanen.** [New observations on the leaf diseases of Plane trees.]—*Verh. Bot. Ver. Prov. Brandenburg*, lxvii, 1, pp. 24–25, 1925.

During the dry early summer of 1924 the leaf disease of plane trees (*Platanus acerifolia*) caused by *Gloeosporium nervisequum* and *G. platani* was much less in evidence in Berlin and its suburbs than in 1923 [see this *Review*, iv, p. 199]. The former fungus was of more frequent occurrence than the latter. According to a verbal communication from Klebahn, *G. nervisequum* develops at the base of the young shoots and destroys them entirely, though the upper part may be completely free from hyphae. In Hamburg the disease is stated to have been very prevalent in 1924, presumably owing to the damp season. Klebahn's description of the symptoms and etiology of the disease (*Jahrb. Wissensch. Bot.*, xli, p. 540, 1905) is cited.

Moll (F.). **Untersuchung auf Imprägnierung von Holz mit Metallsalzen durch Röntgenstrahlen.** [An examination by Röntgen rays of the impregnation of wood with metal salts.]—*Zeitschr. Angew. Chemie*, xxxviii, 27, p. 592, 1925.

Sections of impregnated pine and fir wood measuring 5 to 20 mm. in thickness were examined by a Röntgen apparatus with an electric current of 20 milliamperes. Sodium fluoride solutions, even at the strongest concentrations, did not show at all on the screen, whereas in the wood impregnated with corrosive sublimate the treated zone was thrown into strong relief. Even here, however, the differences between the treated and untreated wood were not so marked as those between the heart and splint wood or the old and new annual rings.

In a test with sections of telegraph poles impregnated with corrosive sublimate or sodium fluoride, the presence of the former was in no case more clearly indicated by the Röntgen process than by the usual method of blackening with ammonium sulphide, which distinctly shows the depth of penetration by the fungicide. So far, therefore, the use of Röntgen rays in connexion with timber impregnation does not appear to hold out much promise of success.

Moll (F.). **Holzindustrielle Technik. Schutz von Holz gegen Verblauen.** [Timber industry technique. The protection of timber against blueing.]—*Holzindustrie*, 155, 1 p., 6th July, 1925.

A brief popular account is given of the blueing of coniferous

timber by fungi [*Ceratostomella* spp.], of which the following preparations are stated to give good control: fungimors (an organic mercury compound supplied by the Grau and Heidel Timber Company), corrosive sublimate, and sodium fluoride [see also this Review, iv, p. 454], all of which are available in Germany at reasonable prices. At Bogalusa, near New Orleans, where the work of timber protection is conducted on a large scale, it is estimated that the losses from decay are reduced from 19 to 1 per cent. by preventive treatment [the technique of which is briefly described].

BESEMFELDER (E. R.). **Neues und rationelles Holz Imprägnierverfahren.** [A new and rational process of timber impregnation.]—*Chem. Zeit.*, xlix, 76, pp. 525–526, 1925.

An essential feature of this new process of timber impregnation is the preliminary 'forced seasoning' of the wood. This is effected by exposing the damp, freshly cut logs, in a specially constructed apparatus, to the action of a vapour current from a boiling, drying, organic fluid. The technique of this preliminary operation is fully described. Wood so treated can be used without further treatment in cabinet making and the like at a saving of Mk. 5 per cb.m.

The process of impregnation, where required, is thus carried out on thoroughly dried and sterilized wood. For constructional timber impregnation with a solution of hard fat is recommended, e. g., hard paraffin (55° C.), which is specially suitable for ornamental purposes, crude ozocerite (75°), stearin or palmitin or their acids, or mixtures of the latter. A further advantage of these substances is that they may readily be combined with paint, which can then be applied simultaneously with the preservative. This method is stated to be very suitable also for parquet flooring. For telegraph poles, pit props, and the like, some standard preservative may be mixed with the fat solution.

A case is cited in which freshly felled beech logs were 'seasoned', impregnated with carbolineum, and ready for use as sleepers on the Austrian railways in three days.

WORMALD (H.) & HARRIS (R. V.). **Note on the bacterial soft rot of Turnips.**—*Ann. of Appl. Biol.*, xii, 3, pp. 326–329, 1925.

From the brief review given in this paper of the literature on the bacterial soft rot of turnips in Great Britain, it would appear that on three occasions the organism isolated from the diseased turnips stained as a *Pseudomonas* and was called *P. destructans*, while on three other occasions it stained as a *Bacillus* with peritrichous flagella, the number of which was not ascertained.

In the case of an outbreak of a soft white rot which, in 1923, destroyed nearly all the turnips on a small plot in a private garden at East Malling, the authors isolated an organism with from 6 to 11 peritrichous flagella, which on inoculation was shown to be pathogenic to young turnip leaves, the rot extending into the crown and later destroying the whole root. This organism, in regard to its fermentation reactions with the sugars tested, and in the other tests carried out, is indistinguishable from *Bacillus carotovorus* Jones and has the same group number as the latter.

NEUWIRTH (F.). **Die Mikromyzeten der Rübenwurzel im Jahre 1924.** [The Micromycetes of Beetroots in the year 1924.]—*Zeitschr. für Zuckerind.* [Prague], xlix, 48, pp. 403–410, and 49, pp. 479–486, 18 figs., 1925. [French summary.]

A description is given of the morphology and cultural characters of the following fungi observed on beetroots in Czecho-Slovakia during 1924, and of the symptoms produced by those that are parasitic. Amongst parasitic fungi were observed *Sclerotinia libertiana* [*S. sclerotiorum*] of which *Botrytis cinerea* and *B. brunneola* are stated to be conidial forms [but see below, p. 58]; *Typhula variabilis* [see this *Review*, iv, p. 521]; *Phoma betae*; *Verticillium lateritium*, which causes the complete decay of the parenchymatous tissues and was found on Rumanian beets attacked by bacteriosis [see next abstract] as well as on Czecho-Slovakian material: this fungus refused to grow on agar and is considered to possess a high degree of parasitism; *Fusarium betae*; *Macrosporium commune*; and *Trichothecium roseum*.

The saprophytic fungi observed were *Penicillium crustaceum*; *P. luteum*; *Aspergillus varians*; *A. niger*; *A. ochraceus*; *Torula convoluta*; *T. beticola* n. sp. [German and Latin diagnoses of which are given]; *Oospora pullulans*; *Tolypomyria alba*; and *Rhizopus nigricans*.

Brief directions are given for the prevention of fungous diseases by cultural and sanitary measures, and a key to the classification of the above-mentioned organisms is appended.

SĂVALESCU (T.) & SANDU (C.). **Bacteriosa Sfeclei de Zahar in România.** [Bacteriosis of Sugar Beets in Rumania.]—*Buletinul Agriculturii* [*Bucharest*], Anul 6, Ser. 2, i, 1–3, pp. 1–9, 4 figs., 1925.

A preliminary account is given of a bacteriosis of sugar beets occurring in the Danube Plain. The disease appears to be distinct from the bacterial gummosis known in Europe and the United States (Sorauer, Handb. der Pflanzenkrankh., ii [p. 61], 1921). The bacteria isolated from diseased material form circular, hyaline colonies measuring 8 to 18 mm. on an agar-bouillon-peptone medium. They differ from *Bacillus betae*, *B. lacerans*, and *B. bussei*, associated with the known form of bacterial gummosis, but have not yet been identified.

The symptoms may be observed from June to August. The foliage turns yellow and withers, and the roots of affected plants present an appearance of more or less advanced putrefaction. In the early stages the tips become soft and flexible and assume an ashen tinge; these symptoms gradually spread to the swollen part of the root, which finally turns black, diminishes in volume, and is frequently destroyed by insects. The vascular bundles show a brown, later black spotting, arranged in characteristic concentric zones. In the advanced stages of the disease, cavities filled with a whitish gum smelling strongly of acetic acid are formed in the parenchymatous tissues. Histolysis begins in the tip and spreads to the body of the root, leaving only the wood fibres intact. Eventually the roots become completely dry and mummified.

Histological examination indicates that the above-mentioned

symptoms are preceded by a purely physiological degeneration of the cells thought to be due to drought. Turgescence was restored by placing the diseased roots in water.

Control measures should include the use of phosphatic fertilizers; soil treatment with a 0·25 to 0·50 per cent. solution of formalin or by steam sterilization; and triennial crop rotation in diseased soil. Directions are also given for general cultural practices.

VERMOREL (V.). **Le permanganate de potasse contre l'Oïdium.** [Permanganate of potash for the control of *Oidium.*]—*Prog. Agric. et Vitic.*, lxxxiv, 30, pp. 80–83, 1 fig., 1925.

Permanganate of potash sprays of the concentration generally in use in French vineyards (120 gm. of the chemical to 100 litres water) are stated by the author to be the sole curative treatment so far known for *Oidium* [*Uncinula necator*] of the vine, sulphur dusts and lime-sulphur sprays being purely preventive. Their action is explained by the fact that in contact with an organic substance the permanganate of potash liberates oxygen, and thus destroys all fungal spores and mycelia with which it comes into contact. The chief disadvantage of such sprays is that their 'wetting' capacity is low in regard to the grapes, which therefore do not receive a sufficient coating of the liquid to be efficient. The addition of silicic sol [a formula for the preparation of which is given] as a spreading agent was shown to be injurious to the grapes, rather deep scorching of the epidermis with subsequent cork formation resulting from the application of such sprays. Much better results were obtained by adding the above-indicated dose of permanganate to Bordeaux mixture or to a lime wash, the first being the more satisfactory. The spray should be applied slowly with a nozzle giving a fine mist, and the nozzle should be kept at a distance from the grapes to avoid the liquid reaching the latter before it is sufficiently finely divided.

MOREAU (L.) & VINET (E.). **La destruction des foyers d'Oïdium.** [The destruction of the foci of *Oidium.*]—*Ann. Soc. Hort., Vign., et Forest. de l'Aube*, xiv, p. 78, 1924. [Abs. in *Bull. Soc. Bot. France*, lxxii, Ser. 5, i, 1–2, p. 285, 1925.]

The ordinary spraying schedule is stated to be insufficient for the control of vine *Oidium* [*Uncinula necator*]. It should be supplemented by treatment during the dormant period in order to destroy the perithecia. The following cultural practices are recommended: stripping the foliage from the vine; application of potassium permanganate; drainage and use of lime on clay and humid soils.

VOGLINO (P.). **I funghi parassiti più dannosi alle piante coltivate nella circoscrizione delle Provincie di Torino, Cuneo e Novara nell' anno 1922–1923.** [The fungi causing most damage to cultivated plants within the bounds of the provinces of Turin, Cuneo, and Novara in the year 1922–1923.]—*Ann. R. Accad. d'Agric. Torino*, lxvii (1924), pp. 93–99, 1925.

Among the records of parasitic fungi contained in this report the following are of interest.

Sclerotinia bulborum produced a wilting of *Gladiolus* plants, the

roots of which were decayed and covered with a cottony, whitish mycelium with black, spherical sclerotia. *S. padi* and *S. fructigena* severely injured the shoots and young fruit of cherries and pears, respectively, in 1922.

Podosphaera oxyacanthae formed white, farinaceous spots on the leaves of kaki [*Diospyros kaki*] in certain nurseries. *Uncinula salicis* caused much damage in some plantations of Burgundy willow, in which it was responsible for the shrivelling and desiccation of the twigs.

Gibberella moricola caused the partial desiccation of mulberry branches, accompanied by splitting of the cortex and the production of the brick-red pustules of *Fusarium*, succeeded by numerous granular, blackish-purple fructifications.

Ophiobolus graminis [*O. cariceti*] caused premature wilting of wheat plants in certain regions during the early part of June.

Phoma lycopersici was responsible for the death of numerous tomato plants at Moncalieri in June, 1923.

Ascochyta hortorum caused damage to the stems and fruit of pepper plants [*Capsicum annuum*], and also a black discoloration and wilting of artichoke [*Cynara scolymus*] bracts.

Fusicoccum abietinum was reported to cause a yellow discoloration and premature leaf fall of white spruce [*Abies pectinata*]. The branches showed large, circular, blackened and necrotic areas, with pustules protruding through the cortex.

Sphaeropsis malorum [*Physalospora cydoniae*] caused the production of brown to black spots and of cankers, as well as by the premature death of the lateral twigs. Some of the leaves showed circular or irregular reddish-brown spots. Apples in storage may also be affected by this fungus, which causes a black discoloration of the epicarp, and is further characterized by the springy texture and ochre-brown colour which it produces in the flesh.

Septoria tibia caused the formation of greyish, ellipsoid spots on the leaves of greenhouse lemons.

Heterosporium variabile caused a serious disease of spinach in the Turin and Chivasso districts in March 1922. The leaves exhibited circular, greyish spots, and a day or two later the entire affected shoot withered. The parasitism of the fungus was readily demonstrated by field inoculation tests.

Pumpkins [*Cucurbita pepo*] were affected by a wilting and decay of the shoots due to *Fusarium vasinfectum* [? *F. niveum*], while *F. lycopersici* caused severe damage to tomatoes.

CAVADAS (D. S.). **La situation phytopathologique au Pélion (Grèce).** [The phytopathological situation at Pelion (Greece).] —*Rev. Path. Vég. et Ent. Agric.*, xii, 2, pp. 164–179, 2 figs., 1925.

Amongst parasitic fungi found on Mount Pelion the most dangerous are stated to be *Plasmopara viticola*, *Phytophthora infestans*, *Venturia inaequalis*, *Coryneum* [*Melanconis*] *modonium*, *Coryneum beijerinckii*, *Oidium tuckeri* [*Uncinula necator*], *Cycloconium oleaginum*, *Sphaerotheca pannosa*, and *Podosphaera leucotricha*, whilst *Bacillus* [*Pseudomonas*] *savastanoi* and the bacterial diseases of tobacco have been the cause of severe damage.

Attention is directed especially to the severe attacks of *C. oleaginum* in the olive groves, causing in many cases complete defoliation. The symptoms are, however, somewhat irregular. The characteristic leaf spots of *Cycloconium* do not stand out individually, but unite into a blackish blotch resembling sooty mould. Frequently the midrib of the leaf is severely attacked and also the peduncle of the fruit. A detailed description of the morphological characters of this fungus is given. Contrary to the statements of previous workers, the author found that the mycelium invades all the tissues as far as the pith of the stem, passing both between and into the cells.

SMALL (W.) **Annual Report of the Government Mycologist.**—*Ann. Rept. Uganda Dept. of Agric. for the year ended 31st December, 1924*, pp. 18–20, 1925.

On the whole, coffee diseases were little in evidence in Uganda during 1924. Material was examined which showed, besides the usual die-back or desiccation due to physiological causes, further cases of combined infestation by *Polyporus coffeae* Wakef. and the root mealy bug (*Pseudococcus citri*) [see this *Review*, ii, p. 409].

The causal organism of the serious root disease of *Coffea arabica* and other plants [see this *Review*, iii, p. 748] has been found to be indistinguishable from *Sclerotium bataticola* [see this *Review*, iv, p. 508] and the use of the name *Rhizoctonia lamellifera* has therefore been discontinued. The disease has not been found to spread by contact, and the conditions governing its attacks on coffee are thought to be the presence of the fungus in the soil, the operation of adverse environmental factors, and the presence or absence of certain biochemical relations between host and parasite. New hosts of *S. bataticola* include garden asters, *Erythrina indica*, *E. umbrosa*, and *E. velutina*, *Albizzia moluccana* and *A. stipulata*, cacao, a species of *Sesbania* grown from seed imported from Kenya, a garden croton (*Codiaeum* sp.), a species of *Eucalyptus* (probably *E. globulus*), *Cupressus macrocarpa*, and *C. benthami*.

The sooty mould (*Meliola glabra*, *Calonectria* sp., and *Arthrosporium parasiticum*), previously found on the green stems and berries and on leaves of *Coffea arabica*, has now been observed also on the foliage of *C. robusta*, and there is some evidence that it is followed by attacks of *Cercospora*.

Hevea rubber remains remarkably free from fungous diseases in Uganda, the only serious troubles at present being *Oidium* leaf mildew [? *Oidium heveae*: see this *Review*, iv, p. 702], first reported in 1921, which appears to be on the increase and is probably responsible for a considerable reduction in the latex yields, especially when its attack coincides with the unfolding of the young leaves. In one case leaf mildew apparently led to a mild die-back of the twigs. The Keuchenius treatment for brown bast [see this *Review*, iv, p. 310] has been adopted on the Government Plantation, Kampala, and elsewhere.

Anthracnose of cotton bolls (*Colletotrichum* sp.) and areolate mildew (*Ramularia areola*) were the only important diseases previously reported on this host in Uganda. The latter is stated to be constantly in evidence, causing severe damage, however, only

during prolonged wet periods. It would appear that insects are the primary cause of most of the damage to cotton bolls and leaves in Uganda. Seedlings infected by anthracnose mostly recovered in the field, but failed to make normal growth and bore few bolls.

Among the fungi reported during 1924 were *Fomes lamaoensis* causing brown root disease of an imported *Sesbania*; *Glomerella cingulata* associated with an anthracnose of wild raspberries; *C. lindemuthianum* on French beans; *Schizophyllum commune, Polystictus fulvo-cinereus,* and *P. caperatus* on buried timber; *Puccinia pruni-spinosae* on peach leaves; *Capnodium brasiliense* on quinine [*Cinchona*] leaves; *Fusarium udum* causing a wilt of *Gypsophila*; *Erysiphe cichoracearum* on tobacco leaves; and *Aecidium crotalariae* on *Crotalaria agatiflora*.

Cacao has not been a success in Uganda and its cultivation has largely been abandoned. It suffers severely from a die-back associated with a species of *Colletotrichum* and *Botryodiplodia theobromae.* Apart from isolated cases of rot due to *Armillaria mellea* and *Helicobasidium longisporum* Wakef., the root system of the trees has generally been healthy and the extensive incidence of die-back must therefore be ascribed to some other cause. Possibly the occurrence of the above-mentioned *S. bataticola* may contribute to the prevalence and severity of this condition.

McDonald (J.). **Annual Report of the Mycologist for the year 1924.**—*Ann. Rept. Kenya Dept. of Agric. for the year ended 31st December, 1924*, pp. 106–111, 1925.

Considerable progress has been made in the investigation of the coffee berry disease [see this *Review*, iv, p. 539], the suspected causal agent, *Colletotrichum coffeanum*, having been definitely implicated in its etiology as the result of an extensive series of inoculation experiments. A particular strain of the fungus, distinct from that associated with brown blight and other minor troubles, is believed to be involved. A spraying programme has been drawn up which should materially reduce the incidence of the disease, and a series of fertilization tests has also been planned.

A disease of coco-nut fruits, causing a splitting of the husk accompanied by exudation of gum, was investigated in the coastal districts and attributed to unfavourable soil conditions during a dry spell. A similar disease is reported to occur in Tanganyika.

A pink mouldiness of maize cobs appears to be fairly widespread throughout the country, varieties with large cobs and a tendency to premature opening of the sheaths being specially affected. The species of *Fusarium* isolated from diseased seeds and proved by inoculation experiments to be pathogenic was identified as being probably the conidial stage of *Gibberella saubinetii.* The fungus was found to be viable in the seed after 13 months' storage under dry conditions.

The roots of dead apple trees in the Thika districts were found to be infested with white ants and, in some cases, to bear the fructifications of *Botryodiplodia theobromae*, which would appear from inoculation experiments to be only a secondary factor in the causation of the disease.

A damping-off of coffee seedlings and a root disease of straw-

berries are both believed to be due to *Rhizoctonia solani*. One of the root diseases of Kenya coffee has been found to be caused by *R. lamellifera* [*Sclerotium bataticola*: see last abstract]. Broom corn (*Andropogon sorghum*) at the Scott Agricultural Laboratories was found to be heavily infected with smut (*Sphacelotheca sorghi*).

The following diseases, in addition to those already mentioned, were observed or definitely identified for the first time in Kenya in 1924: leaf blight of maize (*Helminthosporium turcicum*), which may cause appreciable damage in late plantings of certain varieties, the Natal White Horse Tooth being apparently resistant; *Pestalozzia palmarum* on coco-nut; leaf spot of tobacco (*Cercospora nicotianae*); bitter rot of quinces (*Gloeosporium rufomaculans*); *Tubercularia* sp. and *Poria* sp. on the twigs and broken branches, respectively, of *Sesbania* sp.; and leaf spot of tomatoes (*Septoria lycopersici*).

Brooks (A. J.). **Work connected with insect and fungous pests and their control.**—*Ann. Rept. Dept. of Agric., Colony of the Gambia, for the year 1924*, pp. 13–19, 1925.

Groundnuts [*Arachis hypogaea*] were heavily attacked in 1923–24 by leaf spot (*Cercospora personata*) [see this *Review*, iii, p. 702], which resulted in partial defoliation. Spraying with Bordeaux and similar mixtures is said to have proved ineffective in Africa, India, and the West Indies. During the early stages of the outbreak, dusting with sulphur in the late evening is likely to afford some degree of control in isolated areas, but the most practical measures for general use appear to be the choice of varieties producing a maximum amount of foliage, avoidance of heavy or swampy land, and, in very humid situations, sowing in ridges.

A form of wilt associated with, and believed to be caused by, a species of *Fusarium*, was observed in isolated patches on land where the groundnut crop had been partially destroyed by disease for many years past.

One case of a root disease of groundnut, probably due to *Sclerotium rolfsii*, was observed in the Upper River Province. This disease, which is stated to be rare in the Gambia, may be controlled by thorough drainage, destruction of infected material, and rotation of crops.

Dupont (P. R.). **Annual Report of the Seychelles Department of Agriculture for the year 1924.** 8 pp., 1925.

The following references to the fungous diseases of coco-nut palms, which, on the whole, are said to be not very serious in the Seychelles, are contained in this report (p. 3).

Little leaf [see this *Review*, iv, p. 464], which is frequently confused with bud rot (*Phytophthora*) [*palmivora*: see this *Review*, iv, pp. 414, 415], is the principal leaf disease; its etiology is still very obscure. Stem bleeding disease [see this *Review*, iv, p. 84] is also responsible for the death of a limited number of palms. The occurrence of *Diplodia* [*epicocos*], *Phytophthora* [*palmivora*], and *Pestalozzia* [*palmarum*] has been recorded from a few areas.

Briton-Jones (H. R.). **Mycological work in Egypt during the period 1920–1922.**—*Min. of Agric. Egypt, Tech. and Sci. Service, Bull.* 49 (Bot. Sect.), 129 pp., 11 pl. (7 col.), 1925.

In this bulletin a very detailed account is given of the author's investigations and observations on plant diseases in Egypt from 1920 to 1922, only a few of the more important items of which can be referred to here.

From cotton seedlings affected by sore shin [see this *Review*, iv, p. 648], the symptoms of which at various stages are described, four fungi were isolated, namely, *Alternaria* sp., *Rhizopus nigricans*, *Fusarium* sp., and *Rhizoctonia* sp., of which the three last-named occurred most consistently in culture. The results of inoculation experiments [details of which are given] with these three fungi indicated that the causal organism of sore shin is the *Rhizoctonia*, which was further shown to be capable of attacking the following hosts: castor (*Ricinus communis*), sesame (*Sesamum*) [*indicum*], pumpkin (*Cucurbita* sp.), lubia (*Vigna sinensis*), cabbage, lucerne (*Medicago sativa*), bamia (*Hibiscus esculentus*), groundnut (*Arachis hypogaea*), watermelon (*Citrullus vulgaris*), radish, lettuce, carrot, and peas. It was also found in nature on cress and mustard seedlings, haricot beans [*Phaseolus vulgaris*], *Colocasia* plants, and mature bersim [*Trifolium alexandrinum*], causing severe damage in each case. Besides attacking the above hosts when transferred from cotton, the fungus also proved capable of infecting cotton when passed back from peas, *H. esculentus*, groundnut, watermelon, *V. sinensis*, and mustard.

The morphological characters of the fungus are described, and an account is given of cultural experiments conducted to ascertain the factors limiting its growth. It was shown that the variations in size of the sclerotia in a single strain are governed by the available amount of food, moisture, and oxygen. Potato tubers were found to be a much more satisfactory medium for sclerotial formation than the stems of the same plant.

In sealed tubes the fungus ceased to grow after 24 hours, but it resumed normal development when the tubes were unsealed a fortnight later. The best growth was made in very moist conditions. As shown by Balls (*Year Book, Khed. Agric. Soc.*, Cairo, 1905 and *Ann. Bot.*, xxii, 1908) the exposure of the fungus to a temperature of 50° C. proved uniformly fatal.

There is stated to be no doubt that the causal organism of sore shin is identical with the fungus described by Balls [loc. cit.], and it is referred by the author to *Corticium vagum* [*C. solani*] with the reservation that this fungus contains many forms which may require separation in the future.

Some general recommendations are given for the control of the disease by the adoption of suitable cultural measures, especially in connexion with crop rotation.

A root rot of cotton, *V. sinensis*, and beans (*Phaseolus vulgaris*) was found to be caused by the fungus previously known as *Sclerotium bataticola* Taub. This fungus was shown to be the same as that referred to as *Rhizoctonia solani* Kühn by Shaw (*Mem. Dept. Agric. India, Bot. Ser.*, iv, 6, 1912) and as *R.* sp by Butler (Fungi and Disease in Plants, 1918), and its name is changed in

this bulletin to *Rhizoctonia bataticola* (Taub.) Butl., its morphological characters being described, together with its effects on the cotton plant and other hosts. Though the author's inoculations on cotton failed, he is satisfied that the fungus can cause root rot under certain conditions. Successful inoculations were carried out on beans, *Vigna sinensis*, and *Hibiscus esculentus*.

An account is given of the *Fusarium* wilt of cotton occurring in Beheira and Sharqîya and of the physiological wilt of plants grown on saline soil [see this *Review*, iii, p. 648]. The fungus isolated from diseased material of the former type agreed in cultural and morphological characters with the conidial stage of *Neocosmospora vasinfecta* but it is considered to be identical with *Fusarium vasinfectum*. Pure cultures of the fungus produced the typical symptoms of the disease on healthy cotton seedlings up to three months old.

Among the other diseases observed by the writer may be mentioned *Oidiopsis taurica* on globe artichoke (*Cynara scolymus*) and eggplant (*Solanum melongena*); root rot of globe artichokes caused by *Sclerotium rolfsii*, which formed clamp-connexions (figured on pl. IX) on agar cultures; exanthema, gummosis, and melanose (*Phomopsis citri*) of citrus [see this *Review*, iii, p. 380]; and mango blight (*Bacillus mangiferae*), which produces an irregular spotting of the leaves, a discoloration and disorganization of the stem tissues, and a decay of the fruit accompanied by the exudation of gum at the stem end.

Report of the California Agricultural Experiment Station from July 1, 1923, to June 30, 1924.—84 pp., 1924. [Received October, 1925.]

The following references of phytopathological interest, other than those already noticed in this *Review*, are contained in this report. Further investigation of the shell bark of lemons [see this *Review*, iv, p. 34] has demonstrated the connexion between this disease and the attacks of *Phomopsis californica*.

Experimental work with stocks resistant to crown gall [*Bacterium tumefaciens*] indicated that some highly resistant species, e.g., *Prunus mume*, may prove to be very satisfactory stocks for the apricot and possibly other stone fruits.

Crown rot, believed to be due to a fungus, has been found to affect the northern black walnut [*Juglans hindsii*], formerly thought to be immune [see this *Review*, ii, p. 393].

The use of copper carbonate dust for the control of bunt of wheat [*Tilletia tritici*] is stated to have become general, the results obtained being uniformly superior to those given by the former standard methods of control.

Gloyer (W. O.). **Report of plant disease.**—*Proc. New York State Hort. Soc.*, lxx, pp. 23–29, 1925.

The following were the outstanding diseases of horticultural crops during 1924 in New York State.

Deep scald of apples, which is reported by the Department of Farms and Market Inspectors to have caused 21 per cent. damage in certain cases, produces large, buff-coloured areas, frequently

penetrating to a depth of half an inch, on the less highly coloured portions near the middle of the fruit. The varieties chiefly affected are the Wealthy, Winter Banana, R. I. Greening, Opalescent, and summer apples. In baskets with cushion covers there was 20 per cent. infection and in those with corrugated paper caps only 1 per cent.; air-tight commercial barrels showed 30 per cent. of diseased fruit, while that in the open barrels was sometimes completely sound. Towards the close of the season blue-black, radiating spots may be found in the affected tissue from which *Oospora lactis* has been consistently isolated [see this *Review*, iii, p. 238]. This organism is associated, in a secondary capacity, with a dark spotting of the lenticels. The disease was controlled in box storage by wrapping the fruit in oiled paper containing 15 per cent. mineral oil.

Fireblight [*Bacillus amylovorus*], which in New York occurs almost exclusively on the twigs in spring, caused heavy damage to the Bartlett, Wealthy, and Wagner pear varieties. Good control has been obtained by the application of a mixture consisting of 1 part of mercuric chloride, 1 part of mercuric cyanide, 167 parts of glycerine, and 333 parts of water. The glycerine was found very valuable on account of its tendency to delay desiccation.

In most orchards the delayed dormant spray was an important factor in the control of apple scab [*Venturia inaequalis*]. In some cases the omission of the pre-pink spray resulted in a high degree of infection, while in others the pink or calyx application appeared to be the decisive factor.

Schmidt Bigarreau cherries showed extreme susceptibility to brown rot [*Sclerotinia cinerea*], which also occurred to a noticeable extent on sour cherries along the Hudson, despite the usual applications of sulphur dust.

Cherry leaf spot [*Coccomyces hiemalis*] was very prevalent in commercial orchards, especially on English varieties along the Hudson. The application of a spray or dust after the fruit was picked greatly assisted in preventing defoliation.

Roguing and the use of healthy stock have proved successful in New York for the control of mosaic on the Cuthbert, Columbian, June, Ontario, and Owasco varieties of raspberry, but not on Cayuga, Latham, Marlboro, and Seneca. In the Hudson Valley the spread of the disease is remarkably rapid except on the Newman variety, while Herbert, Ranere (St. Regis), and Erskine Park are also comparatively resistant.

A crown and root rot of strawberries was associated with *Rhizoctonia* and *Botrytis*; leaf spot [*Mycosphaerella fragariae*] was abnormally severe on the Bliss variety.

SHEAR (E. V.) **Recent plant disease work in the Hudson Valley.**—*Proc. New York State Hort. Soc.*, lxx, pp. 81–87, 1925.

The best control of apple scab [*Venturia inaequalis*] in New York was given in 1924 by Jersey dry mix spray [see this *Review*, ii, p. 506] and lime-sulphur 1 in 40 or 1 in 50. Trees protected on 19th April (when the spores of the fungus began to appear in large numbers) with applications of copper sprays, ground sulphur, or lime-sulphur showed considerably less scab than those sprayed on the 23rd or 27th [see preceding abstract]. A further application on

7th May was more effectual in reducing scab than any other treatment given during the entire season.

Gooseberry mildew [*Sphaerotheca mors-uvae*] was very severe in 1924, but was readily controlled by the application of copper-lime or sulphur-lime dusts (85–15) or Bordeaux mixture (3–5–50).

Leaf spot of currants [*Mycosphaerella grossulariae*] has been effectively controlled for the past three years by copper and sulphur dusts or copper and lime-sulphur sprays, applied immediately after blossoming and again just after picking.

In the Chatauqua grape district the use of sulphur dusts has caused heavy damage to the foliage of the vines.

Annual Report of the Iowa Agricultural Experiment Station for fiscal year ending June 30, 1924, 64 pp., 1924. [Received October, 1925.]

The following references of phytopathological interest, other than those already noticed in this *Review*, are contained in the sections on Botany and Plant Pathology (pp. 33–37) and Pomology (pp. 47–51) of this report.

The work on cabbage yellows [*Fusarium conglutinans*] in 1923–24 was chiefly concerned with the production of new resistant strains, of which Iowa No. 5 appears to be very promising.

Maize smut (*Ustilago zeae*) is stated to be gradually becoming a serious factor in production. Near Ames the percentage of infection in 1923 was 9·4, the greater part of which did not appear till August, when rain and high temperature favoured its development. The best germination of the fungus was secured when the spores rested on a moist substratum, while slight germination also occurred on a dry substratum in 100 per cent. atmospheric humidity.

During 1923 the dry rot of maize caused by *Basisporium gallarum* [see this *Review*, iv, p. 537] was widespread, infection ranging from 9 to 67 per cent. in different parts of the State. The symptoms of the disease are similar to those caused by *Diplodia zeae*. The temperature limits for the growth of the organism lie between 10° and 40° C., with an optimum at 25°. Germination, however, follows a different temperature curve and is apparently influenced by other factors [see also this *Review*, iv, p. 304]. *Basisporium* dry rot can readily be eliminated by selection in the germinator.

Both wild and cultivated sumac (*Rhus glabra*) are subject to a twig blight due to a species of *Gnomonia*, which overwinters on old stalks and produces purplish-brown cankers on the young tissues in the spring. By midsummer the young shoots are girdled and killed. Small round spots are formed on the leaves. Two forms of summer spores are produced which assist in the spread of infection. Pruning out the cankers before the beginning of spring growth appears to be an effective control measure.

Further studies on crown rust of oats [*Puccinia lolii*] indicated that *Rhamnus dahurica* and possibly *Berchemia scandens* can act as alternate hosts of the fungus. *R. cathartica* and *R. lanceolata* were again responsible for initial infections [see this *Review*, iii, p. 203].

Work on crown gall [*Bacterium tumefaciens*] is in progress on some 40,000 apple grafts. Attempts are being made to develop a

disinfectant treatment for the graft union, with very favourable results in the case of Bordeaux mixture.

The best treatment for the control of apple blister canker [*Nummularia discreta*] is stated to be the excision of the diseased portion, supplemented by painting with a mixture of white lead, raw linseed oil, and corrosive sublimate, or with ordinary roofing paint.

In the forestry section (p. 51) the value of creosote as a preservative for fence posts is emphasized. Some treated posts of cottonwood [*Populus deltoides*], willow, and possibly elm have given evidence of lasting 25 or more years, compared with only three or four where this precaution is omitted.

LEVINE (M.). **The so-called strands and secondary tumors in the crown gall disease.**—*Phytopath.*, xv, 8, pp. 435–451, 4 pl., 1925.

In continuation of his previous investigations [see this *Review*, iv, pp. 264, 596], the writer carried out a further series of experiments to elucidate certain points in connexion with the formation of strands and secondary tumours in cases of crown gall (*Bacterium tumefaciens*).

In order to ascertain how far apart inoculations must be made to affect the intervening tissue, young shoots of rambler rose, rubber plant (*Ficus elastica*), and tomato, and petioles of *Ricinus* were inoculated at several points from 0·5 to 3 cm. apart. In the rose, rubber, and tomato shoots, the galls fused when the inoculations were made only 0·5 cm. apart, while at greater distances independent growths developed. No instance of the formation of secondary galls between the points of inoculation was noticed. On petioles of *Ricinus* over 18 cm. long, inoculated at a distance of 1 to 3 cm. apart, separate crown galls appeared a few weeks after inoculation.

The effects of inoculating water-soaked tissues on the production of strands and secondary tumours were studied on young Cuthbert raspberry shoots, all of which developed crown galls only at the point of inoculation. It would appear, therefore, that the formation of secondary tumours is not promoted by water soaking [see also this *Review*, iii, pp. 125, 386].

When rapidly growing geranium shoots were inoculated through slits 10 to 12 cm. in length, the cut surfaces began to separate shortly after inoculation, while simultaneously a proliferation of cells occurred in the superficial cambium region. These growths increased in size and finally fused into a mass of crown gall tissue. In slowly growing slit geranium stems small intumescences appeared at the nodes or axils of the leaves, but the growths remained isolated.

When *Bact. tumefaciens* was inoculated into tobacco, geranium, and rose shoots through perforations in the direction of their long axes, 10 to 20 cm. in length, tumours appeared where the stem surface was perforated and strands of new tissue containing vascular elements were formed in the pith along the channel.

Very young and elongating *Ricinus* tissue inoculated with *Bact. tumefaciens* formed hyperplastic growths not restricted to the point

of inoculation but elongating parallel with the direction of the developing organ. Such growths must not be regarded as invasive but are merely the result of the elongation of the inoculated organ [see also this *Review*, iii, p. 16]. Both in stems and petioles the crown gall tissue grows and expands simultaneously with the inoculated organ and forms a series of protuberances or a single elongated swelling visible on the surface. The structures described as strands and secondary tumours would appear, therefore, to be elongated growths of the crown gall tissue. In no case was a gall formed attributable to inoculation at a distant point which could not be explained in this manner. In this respect these so-called secondary tumours, which in crown gall are found only in very young stems and petioles, differ from the permeation metatases in human cancer, which occur as a result of migration through lymph channels of mature structure.

DUCOMET (V.). **Quelques observations et expériences sur les rouilles des céréales.** [Some observations and experiments on the rusts of cereals.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 2, pp. 124–128, 1925.

The author has continued his observations on the evolution of different cereal rusts at Grignon [see this *Review*, iv, p. 658]. A preliminary test suggests the possibility of the transport of rusts on the grain. Uredospores of both the *glumarum-triticina* type and of the *graminis* type were found on the seed coat of wheat, and a spore suspension of these was used for sprinkling young plants. The results were negative for *Puccinia graminis* while only a few pustules of *P. triticina* developed, but a severe infection of *P. glumarum* occurred within ten days.

Inoculations with the teleutospores of *P. triticina* on *Thalictrum glaucum* gave rise to aecidia after 18 days, and the aecidiospores were liberated in 28 days from the time of inoculation. These gave rise to uredospores on wheat after 9 days and teleutospores were produced 15 days later.

The results of laboratory tests showed that the uredospores of *P. glumarum* and *P. triticina* were able to germinate during a period of at least 235 days after formation. Teleutospores of *P. triticina* appear to remain viable for a somewhat shorter period when kept dry.

JACKSON (V. W.), FRASER (W. P.), & BAILEY (D. L.). **The present status of the Barberry eradication campaign in Western Canada.**—*Scient. Agric.*, v, 12, pp. 375–378, 1925.

This is a summary of the results of the Canadian barberry eradication campaign, which has been in progress for the past eight years by the Dominion Department of Agriculture and the Departments of Agriculture of Manitoba, Saskatchewan, and Alberta, in co-operation.

Following the rust [*Puccinia graminis*] epidemic of 1916, which was estimated to have destroyed half the Manitoba wheat crop, barberry was added to the Noxious Weeds Act, and in 1917 over 3,000 bushes were removed from the Winnipeg city parks. Little difficulty was experienced in inducing nurserymen in other localities

to part with the few remaining bushes, the demand for the shrub having always been very restricted in Manitoba; while appeals to the public for assistance in the work of barberry eradication met with a ready response. On the whole, the barberry does not appear to thrive in western Canada.

No distinct connexion can be traced between the occurrence of rust on barberries and the outbreak of local or general epidemics in Manitoba, Saskatchewan, and Alberta. However, the widespread occurrence of rust on barberries throughout Manitoba and in central and southern Saskatchewan is regarded as quite sufficient to justify the destruction of the shrub.

EREMEYEVA (A. M.). Об эцидиальной стадии **Puccinia triticina Eriks.** [On the aecidial stage of *Puccinia triticina* Eriks.]—*Morbi Plantarum*, Leningrad, xiii, 3–4, pp. 123–124, 1924. [Received October, 1925.]

After a brief reference to the discovery of the aecidial stage of *Puccinia triticina* in the United States by Jackson and Mains [see this *Review*, i, p. 166], the author briefly describes her preliminary experiments in the spring of 1924 in the Phytopathological Section of the Chief Botanic Garden in Leningrad, in which she inoculated three Russian species of *Thalictrum* (*T. minus, T. simplex,* and *T. aquilegifolium*) with teleutospores of the rust. Thirteen to fourteen days after inoculation slight swellings appeared on the upper side of some of the infected leaves, while extremely minute spermogonia were formed on the under side of the leaves of *T. minus* alone. No aecidia were formed on any of these hosts.

These results are considered to indicate that in Russia also the genus *Thalictrum* may include hosts for the aecidial stage of *Puccinia triticina.*

FISCHER (E.) & MAYOR (E.). **Zur Kenntnis der auf Gramineen und Thalictrum lebenden heteroecischen Puccinien.** [Contribution to the knowledge of the heteroecious Pucciniaceae inhabiting the Gramineae and *Thalictrum.*]—*Mitt. Naturforsch. Gesellsch. Bern, 1924*, pp. 29–39, 1925.

A species of *Puccinia* of the type of *P. persistens* occurring on *Trisetum distichophyllum* was observed, in the autumn of 1923, to form its aecidial stage on *Thalictrum foetidum.* It was not transferable by inoculation to *T. flavum, T. minus,* or *T. aquilegifolium,* and hence is not identical with *P. persistens, P. elymi, P. triticina,* the *Puccinia* on *Poa nemoralis,* or the form on *Agropyrum cristatum* with which Tranzschel experimented (*Mykol. Zentralbl.*, iv, p. 70, 1914).

The *Puccinia* on *Trisetum distichophyllum* bore no paraphyses in the uredo stage, and on the assumption that the presence or absence of these organs constitutes a specific character, it is differentiated by the authors from *P. distichophylli,* which bears paraphyses, under the name *P. thalictri-distichophylli* n. sp. ad int. On the same assumption it would be necessary to separate the form on *Poa nemoralis* from *P. persistens* and to make other alterations in the present classification of the group.

Several species of this group are characterized by a striking

correlation between host selection and the geographical distribution of the hosts. Jackson and Mains have shown [see this *Review*, i, p. 166] that *P. triticina* develops best on those species of *Thalictrum* which occur in the original home of wheat. On this basis, *P. thalictri-distichophylli* is an example of Alpine endemism.

ESMARCH (F.). **Trockenbeizversuche zur Bekämpfung des Weizensteinbrandes.** [Dusting experiments for the control of Wheat bunt.]—*Die Kranke Pflanze*, ii, 9–10, pp. 190–193, 1925.

The results of preliminary experiments in the control of bunt of wheat [*Tilletia tritici* and *T. levis*] by various dusts (not yet on the market) [see also this *Review*, iv, p. 558] indicated that most of these preparations (which are as yet designated only by numbers) are fully equal to 0·25 per cent. germisan in the elimination of infection. It has not yet been definitely ascertained whether they exercise a similar stimulating effect on germination and yield, but in any case their simplicity of application [the technique of which is briefly described] and other advantages over the liquid treatment seem likely to ensure their extended use in the future.

GRAM (E.). **Tørafsvampning mod Stinkbrand.** [Dusting against stinking smut.]—*Ugeskr. for Landmaend*, lxx, 37, p. 587, 1925.

The results of experiments by Åkerman and Lindberg (described in *Sveriges Almänna Jordbrukstidsskrift*, 35, 1925) in the control of bunt of wheat [*Tilletia tritici* and *T. levis*] by dusting were very satisfactory in the case of dry uspulun and copper carbonate, which reduced the incidence of infection from 7·6 and 8·2 to 0·3 and 0·0 per cent., respectively. The disease was also perfectly controlled by sprinkling with, or immersion in, germisan or uspulun and by sprinkling with copper sulphate, and reduced to a trace by immersion in copper sulphate and treatment with fusariol. Uspulun, germisan, and copper carbonate dust increased the percentage of germination of spring wheat.

MCKINNEY (H. H.) & DAVIS (R. J.). **Preliminary environmental studies on the take-all disease of Wheat caused by Ophiobolus graminis Sacc.**—*Phytopath.*, xv, 8, pp. 494–495, 1925.

Preliminary experiments on the development of the causal organism of take-all of wheat (*Ophiobolus graminis*) [*O. cariceti*: see this *Review*, iv, p. 531] were conducted under controlled greenhouse conditions in Wisconsin soil temperature tanks maintained at temperatures ranging from 8° to 32° C. at intervals of approximately 4°. The soil moistures were maintained near 33, 54, and 71 per cent. of the water-holding capacity of the soil.

The results of four such experiments indicate that *O. cariceti* is an unusually vigorous root and tiller parasite under favourable soil conditions. Infection occurred at all the temperatures employed, being most severe at 12° (in the soil of medium water content) and 16° (at the other two moistures). Diseased plants were rarely found in soil held near 32°. Infection occurred at all soil moistures, the incidence being highest in soils containing the largest amount of water.

DIEHL (O.). **Experimentelle Untersuchungen über die Lebensweise und Bekämpfung des Haferflugbrandes.** [Experimental investigation of the life-history and control of loose smut of Oats.]—*Bot. Arch.*, xi, 1–2, pp. 146–199, 13 figs., 2 diags., 10 tables, 1925.

The mode of natural and artificial infection by loose smut of oats (*Ustilago avenae*) [see this *Review*, iv, p. 158] is described in considerable detail, and the results of field and laboratory experiments in the control of the disease are presented in tabular form and discussed in the text [see also this *Review*, iv, p. 341]. It was established that infection takes place during the flowering of the oats by spores which germinate on the anthers and stigmas as well as between the glumes and the ovary, and form a mycelium which penetrates the superficial parts of the floral organs. This mycelium soon passes into a resting condition. Only exceptionally (as in very dry years) do the spores that enter the space between the glumes remain without germinating until sowing time. Seed artificially infected through the glumes was used in the author's steeping experiments.

Of the preparations tested in the field, namely, uspulun, germisan, and formaldehyde, sprinkling with the last-named at a concentration of 0·15 per cent. gave the most promising results, and there are indications that a lower strength (0·1 per cent.) would suffice to eliminate infection. Two hours' immersion in 0·5 per cent. uspulun reduced the infection to a minimum, but this process cannot be recommended on account of its lengthy duration.

Neither sprinkling with germisan at 0·5 or 0·75 per cent. nor 30 minutes' immersion in the same preparation at 0·25 or 0·375 per cent. gave adequate control of the disease.

It was shown that the testing of fungicides for the control of oat smut can be satisfactorily conducted under laboratory conditions, thereby obviating the various difficulties, such as climatic fluctuations, attaching to field trials. By an examination of the seedlings from treated seed at the point of mycelial invasion, it is possible to ascertain the effect of any preparation in a fortnight. The investigation of the viability of treated mycelium placed in damp chambers is stated to be a more complicated but equally reliable process. Of the preparations tested in the laboratory only sublimoform (0·375 per cent.) and formaldehyde (0·1 per cent.) gave satisfactory results where the sprinkling method was used. Hohenheimer Beize proved effective only in immersion tests. Kalimat and tillantin C reduced the germination of the seed and uspulum dust was a complete failure, its fungicidal components apparently being adsorbed by the glumes.

REED (G. M.). **The inheritance of resistance of Oat hybrids to loose smut.**—*Mycologia,* xvii, 4, pp. 163–181, 1925.

In the present paper details are given of the author's study, up to the F_4 generation, of the inheritance of resistance to the loose smut of oats, *Ustilago avenae,* in a hybrid between the very susceptible *Avena nuda* var. *inermis* (S. N. 30) and the very resistant *A. sativa* var. Black Mesdag (S. N. 70) [see this *Review*, iv, p. 663]. A morphological description is given of the F_1 hybrid, which

resembled a somewhat more robust type of the hull-less parent and which was very fertile, approximately 500 grains being produced by the hybrid plant. A noteworthy feature of the latter was the complete absence of any indication of an intermediate condition in the character of the spikelets, such as has been described by other investigators. As, apparently, only one F_1 hybrid was obtained, its resistance to the smut could not be studied in that generation; the seed obtained from it was divided into two lots, one of which was inoculated with spores, and the other was sown uninfected.

Eighty-two F_2 plants matured from inoculated F_1 seed, of which 25 plants were grown to maturity in the greenhouse and 57 in the field, both under conditions very favourable for the infection of susceptible plants. Twenty-one plants out of the total, i.e. 25·6 per cent., were smutted, and the results indicate rather clearly that resistance is a dominant character and susceptibility recessive, and that these characters depend upon a single factor difference.

No further study of the susceptible F_2 plants could be made as they were prevented by the disease from forming seed, but the behaviour of 42 of the surviving 61 resistant F_2 plants was carefully observed. The results indicated that 30 of the F_2 families gave progeny in the F_3 which was segregating, with an average of susceptibility quite close to a 1 to 3 ratio. The remaining 12 F_2 families gave entirely resistant progeny. These results are considered to corroborate those obtained in the F_2 generation.

In addition, studies were made with the progenies of 58 F_2 plants which had not been inoculated. The results indicated that 28 of these 58 F_3 families showed segregation, the percentage of infection ranging from 3·8 to 58·5; 18 of the families were pure resistants, and the progeny of the remaining twelve plants may be classified as susceptible, the percentage of infection of this group varying from 81·8 to 100 per cent. In this case the latter group had naturally not been eliminated in the F_2 generation.

The data for the F_4 generation are limited, as only a few of the F_3 plants were grown, but the behaviour of the various groups of F_4 progenies so far studied approximated somewhat closely to the requirements of a theoretical interpretation of a three to one ratio.

In terminating, the author discusses the bearing of morphological characteristics on smut resistance, and concludes that there is no definite linkage between the factors for the spikelet and grain characters and resistance to *U. avenae*.

Skaskin (F. D.). Действие горячей воды на споры пыльной головни Овса (**Ustilago avenae (Pers.) Jensen**). [Action of hot water on the spores of the loose smut of Oats (*Ustilago avenae* (Pers.) Jensen).]—Reprinted from *Bull. Don Inst. of Agric. and Amelioration for 1922–1924*, v, pp. 162–178, 1 pl., 1925.

The investigation reported in the present paper was undertaken in view of the still prevalent shortage in Russia of chemical fungicides which, in the author's opinion, may compel the local agriculturists to revert to the method of treating cereal seeds with hot water.

The purpose of the experiments was to determine the action of high temperatures on the germination and development of the

spores of *Ustilago avenae*, suspensions of which were placed in plugged test-tubes, centrifuged, and immersed for 5, 15, and 20 minutes in water baths maintained at temperatures of 45°, 50°, 55°, and 60° C. The germinability of the spores thus treated was tested in hanging drops of sterilized water at 25° C., which, according to the author's unpublished work in collaboration with I. V. Novopokrovsky, is the optimum for the germination of *U. avenae*.

The results indicated that the spores were all killed after an exposure of 5 minutes at 60° C., but at 55° during 5 and 15 minutes and at 50° during 20 minutes some still germinated. These, however, germinated slowly, the promycelia were abnormal in shape and rapidly broke up into gemmae resembling the involution forms of bacteria, and further development was scanty or absent. Treatment at temperatures of 50° during 5 and 15 minutes, and of 45° during 20 minutes, was not so effective, although the percentage of germination was considerably reduced; the gemmae into which the promycelia broke up, and any sporidia that were formed, germinated vigorously, but abnormally.

RIVES (L.). **Sur une maladie occasionnelle de l'Avoine.** [An occasional disease of Oats.]—*Journ. d'Agric. Prat.*, lxxxix, 34, p. 148, 1925.

Many varieties of oats grown at the Toulouse University Experimental Farm, including Gloire d'Ostende, Grise de Houdan, Grise d'Hiver, Early Black Hybrid, and various selections of Red Algerian, were attacked in the spring of 1925 by a root scorch disease associated with *Asterocystis radicis* [see this *Review*, iv, p. 353]. The affected roots presented a vitreous appearance and the foliage showed progressive symptoms of spotting, yellow discoloration, drooping, and eventual desiccation. It is thought that the severity of the disease was aggravated by the unusually dry season and by the 'earthing up' operations carried out in February.

WINSTON (J. R.), BOWMAN (J. J.), & BACH (W. J.). **Relative susceptibility of some Rutaceous plants to attack by the Citrus-scab fungus.**—*Journ. Agric. Res.*, xxx, 11, pp. 1087–1093, 1925.

The data presented in this paper on the relative susceptibility of plants in the family Rutaceae to attack by the citrus scab fungus, recently described by Anna E. Jenkins as *Sphaceloma fawcettii* n. sp. [and by E. J. Butler as *Sporotrichum citri*: see this *Review*, iv, pp. 164, 476] are based on observations made in commercial citrus nursery and grove plantations in the period 1916 to 1924, on studies of rare forms of the hosts interplanted with sour orange seedlings severely affected with scab, and on inoculations made on a number of Rutaceous plants growing in the grounds of the field station of the United States Bureau of Plant Industry at Orlando, Florida, the whole researches involving 2 subfamilies, 2 tribes, 4 subtribes, 22 genera, 35 species, 71 varieties, and 47 hybrid combinations.

The results (given in tabular form) indicate that the fungus attacks a comparatively narrow range of plants of this family, all

of which, with the exception of *Clausena lansium*, belong to only four genera, namely, *Citropsis*, *Poncirus*, *Fortunella*, and *Citrus*, of the subtribe Citrinae. At no time has scab been observed on four species of *Citrus*, namely, *C. ichangensis*, *C. medica* (citron), *C. janos*, and *C. webberi*. As regards hybrids, the data on which are given in a separate table, the results indicate that when both parents are attacked by scab the progeny in general is more likely to be affected by the disease than when only one parent is susceptible, and that liability to scab attack is transmitted from susceptible parents to the F_1 progeny.

ROSEN (H. R.). **Fusarium vasinfectum and the damping off of Cotton seedlings.**—*Phytopath.*, xv, 8, pp. 486–488, 1925.

In May 1923 a very poor stand of cotton seedlings was observed in certain plots of a one-acre field at Fayetteville, Arkansas, which had been heavily infested with cultures of the wilt fungus (*Fusarium vasinfectum*). The field was divided into six sections, different fertilizers being applied to one half of each. On three of these sections the unfertilized plots showed a much poorer stand than the fertilized. A number of the affected seedlings in these plots showed the typical symptoms of damping-off and sore shin [see above, p. 19], while others were rotted before emergence from the soil. From several such seedlings pure cultures of *F. vasinfectum* were obtained.

The three plots receiving kainit (40 lb.), muriate of potash (12 lb.), and Utah potash (12 lb.), respectively, showed a higher stand, compared with the unfertilized plots, than the combination of acid phosphate (34 lb.), nitrate of soda (12 lb.), and muriate of potash (4 or 8 lb.); or the same, but substituting 8 lb. Utah potash for muriate.

The effects of three series of greenhouse inoculation tests on apparently healthy seed were similar to those observed in the field, and pure cultures of *F. vasinfectum* were obtained in nearly every case. It has generally been assumed that damping-off of cotton is chiefly due to *Rhizoctonia*, but there appears to be a strong possibility that *F. vasinfectum* plays an important part in its causation. There is little difference in the symptoms produced by these two organisms, but the discoloration due to *F. vasinfectum* is almost black and occasionally extends upwards through the xylem beyond the rotted collar, while that caused by *Rhizoctonia* is reddish, wine-coloured, or purplish and usually localized at the collar. At about 28° C. *Rhizoctonia* makes much more vigorous growth than *F. vasinfectum*.

F. vasinfectum attacks through the roots and may be expected to cause most severe damage at rather high soil and air temperatures, whereas the *Rhizoctonia* symptoms are likely to be more pronounced in cool, damp weather.

BALLARD (E.). **Some of the causes of low-grade Cotton.**—*Queensland Agric. Journ.*, xxiii, 6, pp. 542–544, 2 figs., 1925.

Cotton is sometimes placed in a low grade as the result of brown, yellow, or black stains produced by internal boll-rotting fungi (in Queensland chiefly *Fusarium moniliforme*), which gain admission to the bolls through punctures made by certain insects, of which the

two specially referred to in this paper are the harlequin or Chinese bug (*Tectocoris lineola*) and the large cotton stainer (*Dysdercus sidae*). In a certain field on the coastal area of Queensland (where the warm, humid climate is very conducive to the development of the fungus) the estimated number of Chinese bugs on 30 acres of cotton was 180,000. The results of a count of the green bolls showed that 50 per cent. were infected with internal boll rot, 27 per cent. with peach moth (*Dichocrocis punctiferalis*) and boll rot combined, and 6 per cent. with pink boll worm (*Platyedra gossypiella*), sometimes in conjunction with internal boll rot.

Hand-picking is stated to be an effective measure of control for the Chinese bug.

KASAI (M.). **Fusarium aspidioti Sawada, its culture and morphology.**—*Ber. Ōhara Inst. Landw. Forsch.*, ii, 5, pp. 547–558, 1 pl., 1925.

In 1921 and 1924 the writer obtained pure cultures of *Fusarium aspidioti*, a parasite on the San José scale (*Aspidiotus perniciosus*) on pear branches, which is believed to occur only in the Shizuoka Prefecture of Japan. This species, which was first described by Sawada (*Bot. Mag., Tokyo*, xxviii, p. (312), 1914), was considered by Petch (*Trans. Brit. Myc. Soc.*, vii, p. 155, 1921) to be identical with McAlpine's *F. epicoccum* (Fungus diseases of citrus trees in Australia, p. 113, 1899).

Details are given of the cultural and morphological characters of the fungus, which is regarded as being distinct from *F. epicoccum* as described by both the above-mentioned authors. The present writer's observations on the shape of the sporodochia (circular or elongated, pulvinate) and conidia (cylindrical, much curved, rounded at the ends), and dimensions of the latter (18 to 37 by 3·5 to 6 μ, average 29·6 by 4 μ) agree much more closely with those of Sawada than with Petch's or McAlpine's diagnosis, and he accordingly considers that the species should not be regarded as synonymous with *F. epicoccum* but should retain the name *F. aspidioti* given to it by Sawada.

RONDELLI (MARIA). **Osservazioni sulla simbiosi ereditaria negli Afidi gallicoli (Eriosoma).** [Observations on hereditary symbiosis in the gall aphids (*Eriosoma*).]—*Atti R. Accad. Sci. Torino, 1924–1925*, lx, 2ª–3ª, pp. 86–88, 1925.

The work of previous investigators on hereditary symbiosis in aphids is briefly reviewed. The examination of two species of *Eriosoma* by Giemsa smears revealed the presence of two forms of symbionts in each. In *E. lanuginosum* these were readily distinguishable from one another, one set of micro-organisms being flask-shaped or allantoid and faintly coloured, while the others were globular and with a small nucleus. In *E. inopinatum*, on the other hand, the two kinds of fungi were somewhat similar, some being flask-shaped like those of *E. lanuginosum*, while others were slender, of variable dimensions, and hook- or S-shaped.

Transverse sections through a very young larva showed that the mycetoma occupied the entire central portion of the insect's

abdomen; in shape it resembled a horse-shoe, the concave part of which enclosed the intestine.

The flask-shaped organisms were observed to remain in the mycetoma while the other forms migrated in large numbers towards the embryo, which they penetrated through the blastoderm. It is therefore probable that two stages of the same fungus are represented in these insects, the flask-shaped bodies constituting the vegetative and the migrant forms the reproductive stages. Further investigations on this point have been planned.

CASTELLANI (A.). **Observations on some diseases of Central America.**—*Journ. Trop. Med. & Hygiene*, xxviii, 1, pp. 1–14, 2 col. pl., 29 figs., 1925.

In this paper [an amplification of one read before the Royal Society of Medicine (Tropical Section) on 13th November, 1924], full clinical and physiological particulars are given of a number of diseases observed by the author during a recent visit to Central America, of which some were of fungal origin.

Internal mycoses appear to be quite common in Central America. Cases of bronchomycosis have been recorded by Picado and others, while cutaneous blastomycosis and sporotrichosis are not infrequent. Ringworm infections are common, and several cases of trichomycosis axillaris flava and rubra were observed.

A description is given of four cases of 'pinta', which is generally defined as a dermatosis characterized by the presence of patches of various colours. The term 'yellow pinta' was found to cover at least two conditions: in the first, a form of tinea flava (see Castellani and Chalmers, Manual of Tropical Medicine, p. 2073, 1919), a fungus agreeing in all respects with *Malassezia tropica,* occurs in profusion; in the other (yellow pinta *sensu stricto*), a few large yeast-like bodies (probably spores of saprophytic fungi) are occasionally found on the yellow, black, and white patches on the chest and arms, but the condition is not thought to be a mycosis.

Under the heading 'black (including bronzine and blue) pinta', several conditions should be differentiated. In (*a*), characterized by patches of black or bronzine hyperpigmentation, occasionally with a bluish tinge, the only fungi found are moulds (*Penicillium*, *Aspergillus*, &c.), identical with those occurring on the skin of natives under normal conditions. The etiological role of such organisms is regarded as very doubtful; in all probability they are of purely saprophytic origin. In (*b*), patches of hyperpigmentation are associated with infection by fungi of the *Trichophyton* group. Chronic infections of this type have been observed in Ceylon to exercise a disturbing action on the pigmentation processes of the skin. In negroes they are common in the inguino-crural region, as well as on the back and chest. In (*c*), the black patches are caused by the presence of *Cladosporium mansoni* (tinea nigra).

'White pinta' includes two conditions: (*a*) leucodermic patches, being the last stage in the depigmentation associated with the above-mentioned amycotic yellow patches; (*b*) depigmentation patches associated with chronic mycotic infections, such as those of the *Trichophyton* and *Malassezia* groups.

Van Slogteren (E.). **Iets over de ziekten der Tulpen.** [Some notes on Tulip diseases.]—*Floralia*, xlvi, 35, pp. 547–549, 4 figs., 1925.

Darwin tulips in Dutch nursery gardens are stated to be very liable to attack by *Botrytis parasitica*, which is particularly prevalent where the same soil has been used for a number of years in succession. In the later stages of the disease the minute, black sclerotia of the fungus are visible on the stalks and the upper part of the bulbs.

Sclerotium tuliparum may be recognized by the absence or diseased condition of the first shoot. The blossom-end of the bulb is covered with the mycelium developing from the white to grey, later brown to black, sclerotia of the fungus. Good control of this disease has been given by steam sterilization of the soil.

The 'wilt' of Murillo and other varieties of tulips, which is apparently due to a combination of adverse physiological factors, is characterized by the exudation of moisture through the stems, leading to a loss of turgor.

Hoare (A. H.). **Iris diseases.**—*Journ. Min. Agric.*, xxxii, 5, pp. 454–458, 2 figs., 1925.

Attention is directed to the susceptibility of the bearded or flag irises, especially the Pongoniris group, to leaf spot or blotch caused by the fungus *Didymellina iridis* [*D. macrospora*: see this *Review*, iv, p. 707], and to the bacterial rhizome rot, but both these diseases are stated to be capable of a certain measure of control by the adoption of suitable cultural practices, particularly exposure to sunlight and the avoidance of water-logged soil.

The leaf blotch disease is characterized by faint yellowish-brown spots which rapidly darken, coalesce, and cover the entire leaf surface, causing the leaf to collapse. The conidia of the imperfect stage, *Heterosporium gracile*, are produced in abundance, especially in the summer and autumn. The perithecial stage has been found in the United States to develop in the following spring on the old dead leaves.

Lack of lime and phosphates favours attack, and attention to this factor, combined with the careful removal and burning of old infected leaves in the autumn, is regarded as the best method of control, since spraying has not given satisfactory results.

The symptoms of the rhizome rot correspond more or less with the description given in Canada [see this *Review*, iii, p. 13] of the disease due to *Bacillus carotovorus*, and an organism belonging to this group has been isolated from infected material in England, though it is thought possible that similar symptoms may be caused by other bacteria that have been reported to attack the rhizome. The disease is favoured by excessive wetness and shade. In severe infections the plants should be removed and burnt, but milder cases may be treated by cutting away the diseased portions and disinfecting the trimmed rhizomes in permanganate of potash before replanting. Applications of lime and superphosphate have been found to reduce the damage caused by this disease, as in the case of leaf blotch.

A leaf rust caused by *Puccinia iridis* has been found occasionally

on wild species and attacks various garden hybrids, but is usually of minor importance.

PAPE (H.). **Beitrag zur Frage der Uebertragbarkeit des Veilchenbrandes (Urocystis violae [Sow.] F. v. Waldh.) durch den Samen.** [Contribution to the question of the transmissibility of Violet smut (*Urocystis violae* [Sow.] F. v. Waldh.) by the seed.]—*Centralbl. für Bakt.*, Ab. 2, lxv, 14–21, pp. 301–307, 5 figs., 1925.

In September 1924 the writer observed a violet (*Viola odorata*) plant of the Königin Charlotte variety with a capsule bearing sori of *Urocystis violae*. The only one of the three valves attacked was dark green, abnormally small, distorted, and with callosities and blisters on the surface, beneath which the dark spore masses could be detected: these were also apparent on the noticeably deformed calyx and on the swollen peduncle.

The infected valve contained two diseased and one healthy seed. The smut sori were situated partly in the seed coat and partly in the parenchymatous tissue of the appendage. Numerous lobate or racemose haustoria issued from the intercellular mycelium and penetrated the cells.

Three infected seeds were sown each in a flower-pot containing sterilized compost, in October, while two apparently healthy seeds from the same capsule and eight from a healthy plant were sown under similar conditions for comparative purposes. All the seeds except one diseased and one healthy came up in the following spring, and at the beginning of May minute pustules of *U. violae* appeared on the petioles of the plants from the infected seeds, the others remaining healthy.

The transmissibility of violet smut by the seed is thus thought to be established.

AGOSTINI (ANGELA). **Una nuova malattia dell' Acacia baileyana F. Muell. (Phyllosticta pollaccii n. sp.).** [A new disease of *Acacia baileyana* F. Muell. (*Phyllosticta pollaccii* n. sp.).]—*Riv. Patol. Veg.*, xv, 7–8, pp. 113–122, 1 fig., 1925.

The author discusses the importance of the acacia from an ornamental and industrial standpoint and gives a list of the fungi parasitic on the genus. This is followed by the description of a disease of *Acacia baileyana* observed in the Sienna Botanic Gardens. The infected leaves become yellowed at the tips, and ultimately show three zones of discoloration, yellow, brown, and grey, from the base towards the tip. On the grey portion the black pycnidia of a *Phyllosticta* occur, this being regarded as a new species to which the name *P. pollaccii*, with a Latin diagnosis, is given. The pycnidia are globose, black, ostiolate, and 100 to 110 μ in diameter. They contain ovate-elliptical, hyaline pycnospores, 4·5 to 6 by 2·5 to 3 μ in diameter.

The disease is not considered serious though it hastens leaf fall. Attacks are confined almost entirely to the older leaves.

BRAUN (H.). **Comparative studies of Pythium debaryanum and two related species from Geranium.**—*Journ. Agric. Res.*, xxx, 11, pp. 1043–1062, 8 pl., 3 graphs, 1925.

The present paper is a report of a comparative study of three

forms of *Pythium* [other than *P. complectens*, described in a former paper and noted in this *Review*, iv, p. 285] involved in the causation of stem rot of *Pelargonium* cuttings, the first of which was identified as *Pythium de Baryanum*, and the other two are described as a new variety *P. de Baryanum* var. *pelargonii*, and a new species *P. splendens*. All three organisms, the pathogenicity of which was proved in inoculation experiments with pure cultures, give rise to similar disease symptoms, consisting in a progressive blackening, shrivelling, and necrosis, starting at the base of the cuttings and rapidly involving the entire stems and petioles. The leaves wilt when the petioles are reached, and the death of the entire plant soon ensues. The pith is hollowed out by a soft, wet rot, but the epidermal layer (except in very young and succulent cuttings) and the fibro-vascular bundles are not attacked until in the late stages, when secondary organisms appear. The rate of progress of the disease is always less rapid in comparatively mature plants, and may be localized when the epidermis is thickly cutinized and the basal tissues are old and woody. *P. de Baryanum* var. *pelargonii* differs from the other two, so far as infection is concerned, only by a slower progress of the discoloration. Cross-inoculation experiments demonstrated that all three forms are also pathogenic to *Coleus*, begonia, and to cucumber and radish seedlings.

A full description is given of the comparative morphology and cultural characters of the organism, and the pathological histology of the rot, together with English diagnoses of *P. de Baryanum* var. *pelargonii* and *P. splendens*. The former is characterized morphologically by a greater variation of the size of the conidia and by the preponderance of the latter over oospores, which are produced only rarely and are often aborted; its oospores are thin-walled, with one to four antheridia. Irregularly swollen intercalary bodies are formed through retraction of the protoplasm, which forms successive septa; these resting bodies are not related to the ageing of the culture media, as they are produced within seven days of plate inoculation. *P. splendens* is characterized by larger conidia, oospores, and oogonia (average 36·2, 26·6, and 31·7 μ, respectively); by the constant presence of three to eight antheridia; by the terminal formation of conidia, no intercalary ones being found; by the preponderance of conidia, oospores being formed only sporadically; and by the germination of the conidia with two to six germ tubes.

In regard to temperature relations, *P. de Baryanum* is characterized by the lowest minimum, a slow growth being evident after 96 hours when cultures were placed directly on ice; this character is sufficiently constant and specific to identify it experimentally within 24 hours. The optimum temperatures of the three forms do not differ greatly, the best growth taking place between 27° and 30° C., but *P. splendens* showed the most luxuriant growth of the three at all temperatures between 20° and 35·5°.

P. de Baryanum showed the highest viability on culture media, and was readily subcultured after 11½ months at room temperature, while the other two were dead after 5½ months, except in one case where *P. splendens* was viable after 8 months. It appears

probable that the relative viability of these forms is correlated with the production of oospores, which are abundant in *P. de Baryanum* and relatively scarce in the other two.

NELSON (R.). **Chrysanthemum yellows. A new disease in the greenhouse.**—*Quart. Bull. Michigan Agric. Exper. Stat.*, vii, 4, pp. 157–160, 1925.

A disease of chrysanthemums, very similar to the destructive aster yellows, has recently appeared in the glass houses in Michigan.

The disease can be recognized with certainty only at flowering time, when affected flowers show, wholly or in part, a sickly green colour, irrespective of the normal colour of the variety. Plants infected early in the season usually produce only diseased flowers. There is frequently a slight yellowing of the leaves, which may show a burning and browning at the edges, a symptom not restricted, however, to this disease. Infected plants do not produce seed.

On asters the yellowing of the foliage serves to distinguish infected plants before blooming, whilst the shoots on badly diseased plants are spindly, shortened, and more numerous than normal. The almost complete identity of the symptoms on these closely related hosts makes it probable that the disease is the same in each case, although this has not yet been proved.

The yellows disease of asters (so called from the resemblance to peach yellows, from which, however, it is probably quite distinct) and of chrysanthemums is considered to be a mosaic. In the Eastern States the leaf-hopper *Cicadula sex-notata* has been found chiefly responsible for the spread of aste r yellows.

The destruction of all infected plants as soon as detected and the fumigation of the greenhouses are recommended.

MCCULLOCH (LUCIA). **Aplanobacter insidiosum n. sp., the cause of an Alfalfa disease.**—*Phytopath.*, xv, 8, pp. 496–497, 1925.

This is a preliminary description of the cultural and morphological characters of the bacterium responsible for the recently discovered vascular disease of lucerne [*Medicago sativa*: see this *Review*, iv, p. 608].

Aplanobacter insidiosum n. sp. is a short, non-motile rod measuring 0·7 to 1·0 by 0·4 to 0·5 μ for single, and 1·8 to 2·0 by 0·4 to 0·5 μ for paired rods. The organism is aerobic, Gram-positive, non-acid-fast, and slow growing. On beef agar the colonies are circular, with entire margins, smooth, shining surfaces, and are flat to slightly convex. Beef gelatine is slowly liquefied. Small amounts of acid are formed from dextrose, lactose, saccharose, and glycerine. Milk is coagulated in 16 to 20 days. The organism is capable of surviving protracted exposure to sunlight, freezing, and desiccation.

The maximum temperature for growth is 31° C., the minimum below 1°, and the optimum about 23°. The thermal death point is about 51° to 52°. According to the 1920 chart of the Society of American Bacteriologists, the group number of the organism is 5331–31135–1222.

VAN OVEREEM (C.). **Beiträge zur Pilzflora von Niederländisch Indien. II (No. 10–13). 11. Ueber eine verheerende Helminthosporiose des bengalischen Grases (Panicum maximum Jacq.).** [Contributions to the fungus flora of the Dutch East Indies. II (No. 10–13). 11. On a destructive helminthosporiose of Guinea Grass (*Panicum maximum* Jacq.).]—*Bull. Jard. Bot. Buitenzorg*, Ser. III, vii, 4, pp. 431–434, 1 fig., 1925.

Plots of Guinea grass (*Panicum maximum*) at the Buitenzorg Veterinary Institute were examined in 1921 on account of a destructive disease which threatened to wipe out this important fodder crop [the cultivation of which is briefly described]. The young leaves and stems were densely covered with small, elongated, purplish-red spots a few mm. in length and 0·5 to 1 mm. in width, and the leaf apices were mostly quite yellow. Growth was stated to have practically ceased some weeks earlier.

The primary cause of the disease was evidently inadequate manuring, which weakened the plants and rendered them liable to attack by a species of *Helminthosporium*. Liberal applications of manure or the removal of the affected plants to rich soil resulted in complete recovery.

The variable, 4- to 6-celled, pale greyish-brown or grey conidiophores, measuring 250 by 5 to 7 μ, generally emerge singly from the stomata. The conidia, which are borne singly at the apex, are elongated, slightly curved, pale brownish-grey outlined with brown, measuring 70 to 140 (generally 90 to 110) by 13 to 16 μ, with 2 to 13 (usually 8 or 9) septa. They germinate readily in water, each of the two terminal cells putting out a hyaline germ-tube which usually divides into two branches.

No other reference to the occurrence of *Helminthosporium* on *P. maximum* could be found, and the species under discussion is thought to be quite distinct from the two others occurring on *P.* spp., namely, *H. flagelloideum* and *H. ustilaginoideum*. The comparatively slender conidia further differentiate it from most other graminicolous forms [see this *Review*, iii, p. 65] and it is accordingly regarded as a new species, to which the name *H. panici* is given.

HENDRICKSON (A. H.). **Oak fungus in orchard trees.**—*California Agric. Exper. Stat. Circ.* 289, 13 pp., 7 figs., 1925.

Nearly all deciduous fruit trees and ornamental shrubs in California are attacked by *Armillaria mellea*, which is locally known as the oak fungus. A description is given of a typical infected orchard. Of the root stocks used for stone fruits at the present time in California, the myrobalan appears to be the most resistant. The French pear (*Pyrus communis*), the Northern Black walnut (*Juglans hindsii*), and the fig (*Ficus carica*) are the only deciduous orchard trees whose resistance has been definitely established. Apples (especially if grown on Delicious stocks) are also usually considered to be resistant.

The native oaks (*Quercus* spp.) are thought to be the chief source of orchard infection, and there is said to be some evidence that the fungus can exist on oak roots without penetrating the cambium and killing the tree. Age and vigour of orchard trees have no bearing on susceptibility.

The following recommendations for control are given. If the disease is confined to a limited area, isolation by means of trenching is often effective; the construction of a concrete wall, extending from slightly below ploughing depth to the bottom of the trench, makes a still more effective barrier to the spread of the rhizomorphs. If the diseased area is extensive, replanting with one or more of the resistant species is necessary. Cases have been observed, when grafting has been done too near the soil level, where the susceptible scion was attacked by disease, while the root was not affected. Attempts to control the disease by cutting out diseased parts and disinfecting the wounds, or by the use of soil disinfectants, have not proved successful.

FITCH (H. W.). **Some promising new features in dusting.**—*Proc. New York State Hort. Soc.*, lxx, pp. 174–182, 1925.

An account is given of a series of dusting experiments carried out during 1923 and 1924 in the Wayne and Orleans counties of New York.

In one orchard, 40-year-old Greening and Baldwin apple trees were used in the tests. The fungicides employed were as follows: 88-10-2 sulphur-lead-cresol dust; 86–10–4 sulphur-lead-malic acid dust; and Schloessing's sulphur-lead dust. Liquid lime-sulphur was used for comparative purposes. Light applications were given on the following dates: 5th, 16th, and 29th May, 12th and 27th June, 14th July, 5th August, and 1st September. Very good control was given by all the preparations, considering the high percentage of scab [*Venturia inaequalis*] on the untreated fruit (74·63 on Greening and 69·38 on Baldwin). The scab spots were extremely small on the dusted apples, very few of which would have failed to pass the test for standard A. The sulphur-lead-cresol dust was the most effective (6·15 per cent. infection on Greening and 7·44 per cent. on Baldwin).

On another farm, 9-year-old McIntosh trees were dusted with 10–80–10 or 20–70–10 precipitated sulphur-talc-lead dust, 33-57–10 coppercarb-lime-lead dust; and 90–10 sulphur-lead dust. Eight applications were given as above. The coppercarb-lime-lead dust gave the best control, reducing the incidence of scab from 80·68 to 12·2 per cent. The 20–70–10 sulphur-talc-lead dust gave twice as good control as the 10–80–10.

In an experiment for the control of peach leaf curl [*Taphrina deformans*] on Elberta trees of different ages, soluble sulphur dust, coppercarb, copper lime, dry lime-sulphur, and liquid lime-sulphur were used, the autumn treatments being given late in November and the spring ones during March. All the dusts gave adequate commercial control, especially when used in the spring, though they were not equal to liquid lime-sulphur. Soluble sulphur dust, which gave the best results, reducing infection from 57·87 to 6·06 per cent. in the autumn tests and from 57·74 to 2·48 per cent. in the spring ones, costs $0·08 per lb.

Quince leaf spot [*Fabraea maculata*] was adequately controlled by five applications of 95–5 sulphur-lead dust on 3rd and 21st June, 8th and 26th July, and 25th August, foliage infection being reduced from 100 to 9·4 per cent. and fruit infection from 99·18

to 10·73 per cent. Copper-lead-lime dust was not at all satisfactory.

The records of foliage infection during the season were found to be closely correlated with the percentage of scabby fruit at harvest time. In general, the treated plots showing 5 per cent. or less foliage infection on 1st June produced 90 to 95 per cent. healthy fruit. When there is 15 to 20 per cent. infection in June the prospects of a clean crop are doubtful.

THOMAS (H. E.). **Root and crown rot of Apples.**—*Proc. New York State Hort. Soc.*, lxx, p. 171, 1925.

Root and crown injury to apple trees in New York is stated to be closely connected with cultural and climatic conditions and quite distinct from the black root rot of the Shenandoah Valley section. Several of the fungi tested appear able to aggravate but not initiate the injury, the chief primary cause of which is believed to be low temperature.

The following measures are suggested as likely to contribute to the recovery of the trees: (1) early cultivation, followed by checking growth later in the season; (2) protection of the roots and crowns in shallow plantings, light soil, or exposed situations by a cover crop or mulch; and (3) bridging from the trunk to the soil in the early stages of the disease.

KIDD (F.) & WEST (C.). **Functional diseases of Apples in cold storage.** *Dept. Sci. and Indust. Res., Food Invest. Board, Special Rept.* 23, 15 pp., 13 pl., 1 graph, 1925.

This paper is reprinted, with slight additions, from the *International Review of the Science and Practice of Agriculture*, N.S., ii, 3, 1924, whence it has already been noticed [see this *Review*, iv, p. 172].

ROBERTS (J. W.). **Unusual defoliation of Peach trees due to active chlorine.**—*U.S. Dept. of Agric. Official Record*, iv, 33, p. 5, 1925.

One of the fungicides used in a recent series of experiments for the control of bacterial spot of peaches (*Bacterium pruni*) was a commercial preparation containing 94 per cent. chloramines and 6 per cent. sodium carbonate, which was dissolved in water at the rate of 1 gm. per 70 c.c. and applied on 19th June. A week after the application 85 per cent. of the foliage was on the ground and the twigs showed small red spots. The fallen leaves were slightly burnt at the margins and frequently showed minute red spots. Except for this, they were green, turgid, and apparently quite healthy.

FARLEY (A. J.). **Spray injury to Peaches.**—*Amer. Fruit Grower*, xlv, 6, pp. 12, 15, 1925.

The results of extensive spraying and chemical tests at the New Jersey Agricultural Experiment Station have led to the following conclusions with regard to the injury produced on peaches by various standard fungicides.

The addition of 1½ lb. of powdered lead arsenate to 50 galls. of

water caused very severe injury when used as a spray, which was slightly reduced by adding 4 lb. hydrated lime to the lead arsenate. A combination of 1½ lb. lead arsenate and 8 lb. sulphur flour with 50 galls. of water caused as severe damage as that with the lead arsenate alone. Self-boiled lime-sulphur with 1½ lb. lead arsenate to 50 galls. caused no injury. In the dry-mix sulphur-lime spray [see this *Review*, ii, p. 506], containing 8 lb. sulphur per 50 galls., to which 1½ lb. lead arsenate was added, the injury decreased with an increasing amount of lime, though even with 6 lb. of the latter the damage was not entirely prevented, while the increase of lead arsenate to 2½ lb. materially augmented the extent of the injury.

Absolutely no damage was caused by the standard dry-mix spray without lead arsenate, while only negligible damage resulted from two applications of the former with 1 lb. lead arsenate per 50 galls., and the same was the case even when the lime was decreased from 4 to 2 lb.

Injury from calcium arsenate was apparent after ten days, while that following the use of lead arsenate did not show until three weeks after spraying. One pound of lead arsenate per 50 galls. spray mixture caused no appreciable injury in mixtures in which the lime content ranged from 2 to 6 and the sulphur from 4 to 8 lb.

Calcium hydroxide which has changed to calcium carbonate should not be used with lead arsenate, as it tends to increase the water-soluble arsenic. The injury is not due to the water-soluble arsenic contained in the lead arsenate at the time of application, but to the soluble arsenic formed after spraying.

On the basis of these data and of general observations it is recommended that lead arsenate alone, or in combination with lime, should never be applied to peaches during the growing season, while 1 lb. per 50 galls. of dry-mix sulphur-lime is the maximum amount consistent with safety. Fresh lime, containing not less than 90 per cent. calcium oxide, should be used in preparing the dry-mix lime spray.

BROOKS (C.) & FISHER (D. F.). **Spraying for brown rot in the Northwest.**—*Amer. Fruit Grower*, xlv, 6, pp. 10, 25, 34, 1925.

During the period 1915 to 1919 investigations on the control of brown rot [*Sclerotinia cinerea*] on sweet cherries and Italian prunes were carried out in the vicinity of Portland, Oregon [see also this *Review*, iv, p. 39]. Since that time there has been a revival of interest in this work owing to the epidemic of brown rot in 1923, which reduced the sweet cherry crop by 30 per cent.

In the five years of the tests, there was never more than a trace of brown rot on sprayed or unsprayed cherries in the orchard, yet in the shipments the untreated fruit consistently showed from 2 to 22 times as much infection as the treated. The average amount of infection on unsprayed shipped fruit was 23·5 per cent., compared with 6·4 per cent. on the treated cherries. Similarly with Italian prunes, which at harvesting showed 47 and 1·6 per cent. brown rot on unsprayed and sprayed trees, respectively, the average amount of infection on untreated shipped fruit was 28·2 per cent., compared with 7·2 per cent. on the treated prunes. On the Agen variety the

amount of infection developing in transit was 14 times as great in the untreated as in the treated fruit.

Directions for the application of the spraying schedule are given [see this *Review*, iii, p. 522]. Self-boiled lime-sulphur gave the best results on prunes. On cherries Bordeaux mixture or self-boiled lime-sulphur caused a marked reduction in the size of the fruit, and even lime-sulphur was somewhat injurious in this respect, though less so than the other standard materials. The use of resin-fish-oil soap increased the efficiency of the sprays and also greatly reduced the incidence of cracking on ripening cherries due to showery weather.

Spraying gave no control of black mould (*Rhizopus*) and blue mould [*Penicillium*], which can only be checked by prompt cooling, careful handling, and removal of defective fruit at packing.

STEVENS (N. E.). **Strawberry diseases.**—*U.S. Dept. of Agric. Farmers' Bull.* 1458, 10 pp., 5 figs., 1925.

A short account is given of the symptoms and control of the following strawberry diseases in the United States: leaf spot (*Mycosphaerella fragariae*), scorch (*Mollisia earliana*) [*Diplocarpon earliana*: see this *Review*, iii, p. 588], leaf blight (*Dendrophoma obscurans*), mildew (*Sphaerotheca humuli*), grey mould (*Botrytis* sp.), tan rot (*Pezizella lythri*), leather rot (*Phytophthora cactorum*), hard rot (*Rhizoctonia* sp.), and leak (*Rhizopus nigricans*).

VASSILIEVSKY (N. I.). К биологии **Septoria ribis Desm.** на Черной Смородине. [Contribution to the biology of *Septoria ribis* Desm. on Black Currants.]—*Morbi Plantarum*, Leningrad, xiii, 1, pp. 12–21, 1924. [German summary. Received October, 1925.]

Besides the ordinary spots caused by *Septoria ribis* Desm. on the leaves of species of *Ribes*, as described by Diedicke [whose diagnosis is reproduced], the author observed in 1923, on *Ribes nigrum*, other large, irregular, brown spots, frequently extending over the greater portion of the thick leathery leaves, and not becoming grey or whitish on drying. These were found to be due to a form of the same fungus whose fructifications, generally originating under the epidermis as dense balls of interwoven hyaline hyphae, were found on the spots. As these balls increase in size, but long before full growth, their tissue begins to deliquesce, usually at the top, and to be replaced by spores, the process advancing gradually in depth and laterally. It is believed that the rupture of the leaf epidermis occurs as soon as the spores begin to form, and that the fructifications retain the power of increasing in size for some time after this.

The fructifications are very variable in size. Some have a very wide opening and a layer of spores on the base of the fruit body, which is curved or almost flat and resembles the acervulus of the Melanconiaceae. Their wall consists of hyaline plectenchyma or indistinct pseudoparenchyma resting on the altered host tissue; in its lower portion, the wall is occasionally considerably thickened, growing thinner towards the opening, which it may or may not reach; in the latter case the opening cannot be correctly termed

an ostiole, as it is only bordered by the leaf epidermis. Other fructifications have a fairly narrow opening and a regular spherical shape, with spores disposed along almost the whole of their periphery, occasionally up to the opening. Such fructifications are somewhat like pycnidia, while those collected later in the season are still more so, and finally, in the autumn, true pycnidia with well-developed, thick, brown pseudoparenchymatous walls are formed.

The spores are borne on short, fairly stout, usually conical conidiophores, and are 25 to 68 by 1·5 to 2·5 μ in diameter, straight or curved, somewhat thickened and obtuse at the base, tapering and pointed at the apex; more rarely they are obtuse or pointed at both ends. Septa and oil drops may or may not be present, the number of septa varying from one to three. On germination in water they swell slightly and form, at the ends or on the sides in the vicinity of the septa, processes which may either elongate into hyphae or, less often, may bear *Septoria*-like conidia either singly or in groups of 2 to 3; the latter may also arise directly on the spore, or may be abstricted from lateral branches on the growing hyphae. In nutrient media black, warty, stromatic bodies, as large as a pea and sometimes bearing tufts of *Septoria*-like conidia in small depressions, developed. These contained round or irregular sclerotia, the centre of which consisted of spherical, hyaline cells, rich in oil.

Besides occurring on the leaves, the fungus was found attacking the fruit of the black currant in the nursery of the All-Russian Agricultural Museum [Leningrad]. On the still green berries, a short time before their maturing, small, rounded, brown, somewhat depressed, and sometimes split spots appeared, which did not change colour when the berries turned black. These bore one to many black, slightly raised, covered fruit bodies. The tissue underlying the spots was permeated by hyaline hyphae and contained numerous mycelial agglomerations situated either immediately under the epidermis or more deeply. In some cases these developed into spherical sclerotia, up to 175 μ in diameter, and with a brown, pseudoparenchymatous wall. Occasionally fruit bodies with *Septoria*-like spores were also found just under the epidermis and opening to the exterior more or less widely. These resembled the fructifications on the leaves. In some cases their lower portion was half filled with a hyaline tissue, on the surface of which was a layer of spores, thus forming an intermediate stage between sclerotia and pycnidia. Their spores were of the same shape as those from the leaves and their dimensions were 40 to 77 by 1·5 to 2·8 μ, with one to three, or even six septa.

Pure cultures from spores taken from the fruit bodies on the berries were identical with those from spores collected on the leaves, in macroscopical and morphological details. A further proof of the identity of the two forms was supplied by successful inoculations of the black currant leaves with pure cultures from spores from the berries, *Septoria ribis* being recovered from the resulting lesions. The inoculations only succeeded on the lower side of the leaves, the first symptoms appearing after a week.

In an attempt to establish how infection of the berries occurs in nature, the author kept under careful observation, during the blossoming period in 1923, the plot of black currants in which

the berries had been most heavily affected in 1922, but could not find any flowers showing any abnormality, nor any sign of infection of the young berries. The disease appeared suddenly, shortly before the berries began to turn black. All attempts to infect the black currant flowers artificially at different stages of their development, either in the field (where all the infected flowers fell off) or in the laboratory, gave negative results.

On the spots that appear on the leaves towards the end of the summer, the pycnidia are replaced by sclerotia. As these increase in size and rupture the epidermis, they develop a dark-coloured wall. The fully formed sclerotia are up to 130 μ in diameter, round, papillate, with a nucleus of hyaline, round cells containing oil drops, and bounded by a well-developed wall of several layers of thick-walled, brown cells.

On the fallen leaves in early spring perithecia with immature asci were found to have developed from the sclerotia, and later collections gave mature perithecia which liberated their spores towards the end of May, when the blossoming of the black currants had already started. Perithecia with mature asci containing spores were also found occasionally both earlier and as late as the middle of June. In this stage the fungus was identified as *Mycosphaerella grossulariae* (Fr.) Lind; the asci were 50 to 75 by 8 to 11 μ in diameter and contained 2-celled, hyaline spores, 26 to 38 by 3 to 3·5 μ. A description is given of the author's infection experiments, which confirm Stone's work showing that *M. grossulariae* is the perfect stage of *S. ribis*.

In terminating, the author discusses the economic inportance of the disease, especially of the new form of infection of the berries, of which this is the first record, so far as he is aware, and also gives some recommendations for its control, chiefly consisting of the destruction by fire of all the fallen leaves, and in spraying the bushes with Bordeaux mixture several times during the season, special care being taken to spray thoroughly the under side of the leaves.

Disease in Manning River Bananas.—*Queensland Agric. Journ.*, xxiv, 3, p. 304, 1925.

During the past two years plantain bananas in the Manning River district have been almost wiped out by a disease which is believed by Dr. R. J. Noble, of the New South Wales Department of Agriculture, to be primarily due to a species of *Fusarium* quite distinct from any of those attacking bananas in other parts of the world. The fungus generally enters through the root system. In the later stages other organisms combine to produce a rotting of the plant which is accompanied by a most offensive odour. For the present, the only control measures to be recommended are the destruction of infected material, disinfection of implements before use on healthy plants, and selection of resistant stock for propagation in affected areas.

Ghirlanda (C.). **Sopra una malattia del Fico.** [On a disease of the Fig.]—*Ann. R. Accad. d'Agric. Torino*, lxvii (1924), pp. 71–76, 2 figs., 1925.

Towards the end of August, 1923, a decay of the receptacles of

an otherwise healthy-looking fig tree of the Troiano or Livia variety was observed at Turin.

The affected portions of the fruit showed on the concave side large, round, depressed areas, surrounded by a dark ring. On green fruits with longitudinal yellow stripes these areas were largely covered by a thin, flocculent, olive-brown layer. The causal organism was isolated, cultured on fig decoction at 25° to 26° C., and shown to be identical with *Alternaria fici*, the morphological and physiological characters of which are briefly described. Inoculations on healthy fruits gave positive results.

Complete control of the disease was obtained by two applications of neutral Bordeaux mixture at 0·5 and 1 per cent., respectively, at an interval of twelve days, supplemented by a dormant spray in February of 2·5 per cent. Bordeaux.

Spray for Pecan scab.—*Amer. Fruit Grower*, xlv, 6, p. 15, 1925.

According to G. H. Blackman, of the Florida Agricultural Experiment Station, the best summer spray for pecan scab [*Fusicladium effusum*: see also this *Review*, iv, p. 73] is 4–4–50 Bordeaux mixture plus 1 lb. lead arsenate and ½ lb. kayso or oil paste. This mixture should be applied every three to six weeks, according to weather conditions, at a pressure of 200 to 300 lb. The summer spraying should be preceded by one application of lime-sulphur (1 in 6 or 8) just before the buds start growth.

RAMSEY (G. B.). **Fumigation injury of Watermelons.**—*Phytopath.*, xv, 8, pp. 479–481, 1 fig., 1925.

Recent examinations, by the Food Products Inspectors of the Bureau of Agricultural Economics, of cars of Californian watermelons revealed a peculiar type of injury, somewhat resembling anthracnose [*Colletotrichum lagenarium*], which it was suggested might be due to fumigation by formaldehyde, since only fruit subjected to this process showed the typical blistering and pitting.

In order to test the validity of this explanation a perfectly healthy melon was placed in a closed transfer chamber and subjected to fumigation by 16 oz. potassium permanganate and 20 oz. formaldehyde per 1,000 cu. ft. of air space. At the end of the standard four-hour period no changes were observed. After 14 hours the door of the chamber was opened and the remaining fumes allowed to escape, and at the end of a further 27 hours definite pits, one-eighth to one-half an inch in diameter, were scattered irregularly over the surface of the melon. The larger and deeper lesions occurred where the fruit was slightly bruised or the cuticle rubbed off.

This experiment clearly proves that fumigation by formaldehyde is capable of causing damage which may result in very heavy losses, and indicates the advisability of devising some improved method of treatment.

HOUBEN (J.) & HILGENDORFF (G.). **Ueber Obstbaum-Karbolineum. I.** [Fruit tree carbolineum. I.]—*Arb. Biol. Reichsanst. Land- und Forstwirtsch.*, xiv, 2 pp. 109–162, 1925.

The composition of 17 different commercial brands of fruit tree

carbolineum was ascertained by distillation and analysis. Important differences [which are presented in tabular form] were detected in the preparations examined, especially as regards phenol and water content.

In addition to a certain amount of injury caused by spring applications of various carbolineum preparations, a striking stimulus to the growth of new buds on apple trees was observed. In general, the damage caused was not sufficiently severe or uniform to preclude the use of 20 per cent. emulsions. When the strength was raised to 50 per cent. the damage caused to apple trees was almost as severe as with undiluted preparations, and the healing of wounds was similarly retarded.

Apple, pear, and plum trees receiving spring applications of the principal constituents of the carbolineum preparations were severely damaged in two consecutive seasons both by the phenols and the organic bases, while naphthalene and anthracene caused little injury. Of the phenols, the cresols, especially m-cresol, produced the most detrimental effects. Naphthalene occasionally favoured the process of wound healing, but the latter was consistently impeded by the phenols and organic bases.

An increase of the phenol content of three readily emulsible carbolineum preparations caused injury to buds and flowers and to very young fruits of trees receiving the 20 per cent. spring treatment. The damage began to be apparent on apple trees at a 4 per cent. increase of the phenol content of the initial preparations; while similar effects were observed on pears at 5, on plums at 6, and on cherries at 10 per cent. Besides the injury caused by the direct action of the phenols, the reduction of emulsibility caused by their addition must be taken into consideration.

Emulsibility and stability are essential requirements in the manufacture of carbolineum preparations, but most of those tested proved unsatisfactory in these respects. It was observed that the disintegration of the watery emulsions may be accompanied by the secretion of a product with a totally different composition; so that, for example, the phenol content may rise considerably above that of the initial preparation, thereby converting an otherwise innocuous product into a very risky one by reason of the instability of its emulsion.

It is observed that the above data, in connexion with the effects of the 20 and 50 per cent. emulsions and with the action of the phenols and organic bases, require confirmation.

A bibliography of 100 titles is appended.

CATHCART (C. S.) & WILLIS (R. L.). **Analyses of materials sold as insecticides and fungicides during 1924.**—*New Jersey Agric. Exper. Stat. Dept. of Chemistry Bull.* 407, 16 pp., 1924. [Received November, 1925.]

Among the 110 official samples of insecticides and fungicides analysed in 1924 and reported on in this bulletin, the following are of interest [see also this *Review*, iv, p. 556]. Thirteen brands of Bordeaux mixture as follows: Bordeaux mixture powder (Ansbacher Insecticide Co., Inc., New York City) containing 17·05 per cent. metallic copper; Lion Brand Bordeaux mixture (Jas. A. Blanchard

Co., New York City), 4·38 per cent.; Bordeaux mixture powder (General Chemical Co., New York City), 22·9 per cent.; Bordeaux mixture powder (Grasselli Chemical Co., New York City), 14·46 per cent.; dry and liquid modified Kil-Tone (Kil-Tone Co., Vineland, New Jersey), 23·20 and 11·91 per cent., respectively; Key Brand Bordeaux mixture, powder and paste (Interstate Chemical Co., Jersey City, New Jersey), 13·55 and 10·22 per cent., respectively; Anchor Brand dry Bordeaux mixture (Leggett & Bro., Inc., New York City), 13·27 per cent.; Bordo mixture dry powder 25 per cent. (John Lucas & Co., Inc., Philadelphia, Pa.), 13·27 per cent.; Bordeaux mixture (Riches, Piver & Co., New York City), 27·14 per cent.; Fungi-Bordo (Sherwin-Williams Co., Newark, N.J.), 12·63 per cent.; and 'Electro' dry powdered Bordo mixture (Vreeland Chemical Mfg. Co., Little Falls, N.J.), 19·94 per cent. With the exception of Fungi-Bordo, which contained 0·12 per cent. less metallic copper than guaranteed, all the preparations sustained the claims made for their composition.

Two samples of atomic sulphur were submitted by the General Chemical Co., containing 48·49 and 47·60 per cent. total sulphur, respectively. Sulpho-Tone (Kil-Tone Co.), contained 62·14 per cent. total sulphur, and Niagara dry-mix and Niagara 80–20 mixture (Niagara Sprayer Co., Middleport, N.Y.), 62·15 and 80·70 per cent., respectively.

Lion Brand lime-sulphur solution (Jas. A. Blanchard Co.) contained 24·33 per cent. total sulphur; lime-sulphur solution (Grasselli Chemical Co. and Mechling Bros. Chemical Co., Camden, N.J.), 25·90 and 26·03 per cent., respectively.

Bowker's dry lime-sulphur (Bowker Chemical Co., New York City) contained 60·49 per cent. total sulphur; B.T.S. (General Chemical Co.) 42·76 per cent.; dry lime-sulphur (Interstate Chemical Co., John Lucas & Co., Inc., and Sherwin-Williams Co.), 66·60, 62·58, and 59·78 per cent., respectively.

The following preparations of the Niagara Sprayer Co. were analysed: special mixture No. 161 potato dust contained 8·65 per cent. total arsenic, 0·22 per cent. water-soluble arsenic, and 7·31 per cent. copper; Niagara 70–10–20 mixture, 2·42 per cent. total arsenic, 0·41 per cent. water-soluble arsenic, and 77·16 per cent. sulphur; Niagara potato dust mixture (without poison), 7·34 per cent. metallic copper; Niagara All-in-One mixture, 2·29 per cent. total arsenic, 0·36 per cent. water-soluble arsenic, 60·76 per cent. sulphur, and 2·77 per cent. nicotine; Niagara pomodust, 2·05 per cent. total arsenic, 0·27 per cent. water-soluble arsenic, and 90·23 per cent. sulphur; Niagara 85–15 dusting mixture, 2·60 per cent. total arsenic, 0·45 per cent. water-soluble arsenic, and 87 per cent. sulphur; Niagara viti dust, 3·83 per cent. total arsenic, 0·36 per cent. water-soluble arsenic, and 4·12 per cent. metallic copper.

Skinner's special 30–70 copper lime dust (Skinner Machinery Co., Dunedin, Fla.) contained 12·11 per cent. metallic copper.

GUYOT (L.). **Les anticryptogamiques colloïdaux.** [Colloidal fungicides.]—*Jour. d'Agric. Prat.*, lxxxix, 39, pp. 250–252, 1925.

This is a brief summary of the present position with regard to the use of colloidal fungicides, the chemistry of which is explained.

Reference is made to the tests of these substances made by various investigators, most of which have already been noticed in this *Review*, from other sources.

Aoi (S.). **Ueber den Zusammenhang der desinfizierenden Wirkung von Kupfersalzen mit ihren eiweissfällenden Eigenschaften.** [On the connexion between the disinfectant action of copper salts and their albumin coagulating properties.]—*Dissert. Bern*, 26 pp., 1925. [Abs. in *Bot. Centralbl.*, N.F., vi, 5–6, pp. 148–149, 1925.]

Assuming that in disinfection with copper salts the destruction of the disease-producing organisms is effected by an irreversible modification in the state of the protoplasmic albumin, the writer analysed the albumin coagulating action of various copper preparations.

The coagulating capacity was found to be greatest in $CuSO_4$, decreasing through $Cu(NO_3)_2$ to copper acetate and $CuCl_2$. The examination of complex compounds of copper with electrolytes showed for copper potassium sulphate the same action as for $CuSO_4$; copper ammonium sulphate has a slighter coagulating action.

The origin of this albumin coagulation is attributed to the action of the Cu-ion, which is alleged to form insoluble complex compounds with the albumin, the size of the molecules being dependent on the degree of hydration of the Cu-ion. The dependence of the hydration of the ions on the ion-concentration, whereby a maximum is attained as the concentration rises, would explain the increase of coagulation to a maximum and the subsequent disintegration. In dilute solutions the tendency of the ions to hydration is greater, resulting in a coagulation which, with the increase of ion hydration accompanied by molecular reduction, may be brought into solution again.

The disinfectant action of copper salts is therefore related to their capacity for coagulating albumin. Except for iodine salts, strong electrolytes appear to exert no appreciable action on the process. On the other hand, the solution of the albumin-copper precipitations is readily effected by weak electrolytes, ammonium compounds, and salts of organic acids. The change in coloration induced by the latter argues a modification in the state of the Cu-ion.

Voglino (P.). **Il servizio fitopatologico in Italia.** [The phytopathological service in Italy.]—*Ann. R. Accad. d'Agric. Torino*, lxvii (1924), pp. 49–56, 1925.

An account is given of the organization of the Italian phytopathological service and various suggestions are made for its amplification in certain directions. Among the measures advocated are the training of forest rangers and other rural officials, members of the militia, and the like, in the rudiments of phytopathology; the arrangement of special courses for the peasantry; and an increase in the phytopathological staff.

The service should consist of a central Institute working in co-operation in the administrative and executive branch of the Ministry of Agriculture; experimental institutes, colleges, and

laboratories engaged in research on the parasitic diseases of plants and their control; local phytopathological observatories occupied in the field study of plant diseases and giving directions for their control, in the execution of which the provincial councils of agriculture should assist; and the rural guards referred to above.

The *Phylloxera* problem, owing to its complexity and importance, should not be placed in the general phytopathological cadre but should form the subject of a special organization.

MAUBLANC (A.). **Conseils pour l'étude sur place des maladies cryptogamiques aux colonies et pour l'envoi d'échantillons d'étude.** [Recommendations as regards the local study of cryptogamic diseases in the colonies and the sending of specimens for examination.]—*Agron. Colon.*, xiii, 92, pp. 57–61, 1925.

The local study of plant diseases has not been extensively pursued in the French colonies, and until this is more fully developed it is necessary to send specimens to France for investigation. The writer points out the disadvantages of this procedure.

Detailed instructions are given as to the correct method for collection, preparation, packing, and sending of these samples.

CHAUDHURI (H.) & RAJARAM. **Ein Fall von wahrscheinlicher Symbiose eines Pilzes mit Marchantia nepalensis.** [A case of probable symbiosis of a fungus with *Marchantia nepalensis*.] —*Flora*, N.F., xx, 1–2, pp. 176–178, 2 figs., 1925.

During the period 1922–24 it was observed that all the vigorous specimens of *Marchantia nepalensis* which were collected in large numbers round Lahore, India, contained a fungus in the thallus. Some of these liverworts were growing in clay, and others in sandy soil. They throve in pots and on filter paper saturated with a nutrient solution in the laboratory.

The fungus was only found in the gametophyte and was restricted to a zone below the air canals. The hyphae were branched and tortuous within the cells, the walls of which were swollen and discoloured. Chlamydospores were occasionally observed. The infected zone sometimes exhibited a distinct purple coloration. In very young plants the fungus could be detected in the lowest cells of the thallus and in the rhizoids, from which it subsequently disappeared. Repeated isolations under aseptic conditions at 22° to 24° C. consistently yielded the same sterile mycelium, the hyphae growing out of the host tissue in three to five days. Fresh gemmae were readily infected by contact with the hyphae on damp filter paper.

Young *Marchantia* plants were grown without the fungus in a normal nutrient solution on filter paper or sterilized soil, for comparison with those cultivated in the presence of the symbiont. Under the former conditions the plants developed normally but rapidly withered without producing sporophytes. The fungus, therefore, is evidently essential to the full development of the host.

The symbiont was cultivated on a variety of media. Very slight production of alkali was observed on red lactose agar. Good growth was made on media with a reaction of P_H 6·6 to 7.

When deprived of maltose on Coons's synthetic medium the fungus entirely failed to develop, whereas asparagin could be withdrawn without appreciable alteration. It would therefore appear that the fungus is dependent on the host, at any rate for the supply of carbohydrates. Since the host, in its turn, is entirely dependent on the fungus for its existence, it is concluded that the relation is one of reciprocal symbiosis.

MAGROU (J.). **Rôle des champignons endophytes dans la culture des Orchidées.** [Role of endophytic fungi in orchid growing.] —*Rev. Path. Vég. et Ent. Agric.*, xii, 2, pp. 180–184, 1925.

The author gives a short description of Noël Bernard's work on orchid mycorrhiza and of its practical application by orchid growers, most of whom are stated to be now making use of cultures of the mycorrhizal fungi for germinating their seed.

WOLFF (J.). **Observations sur les divers modes de culture des Orchidées.** [Observations on various methods of Orchid cultivation.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 2, pp. 185–190, 1925.

A review is given of previous investigations in relation to the germination of orchid seeds, both by means of mycorrhizal fungi and asymbiotically.

The results of the experiments made by the author in conjunction with J. Potin have been already noticed in part [see this *Review*, iii, pp. 97, 359]. In the present paper, attention is directed to the influence of the age of the seed on its germination in the absence of the fungus. Some seeds sown on a medium containing 2·5 per cent. glucose lose their germinating capacity in 45 days, others in from two or four months. Seeds kept dry in vacuum do not lose the power of germination so rapidly.

COSTANTIN (J.). **Remarques sur les cultures asymbiotiques.** [Observations on asymbiotic plant growth.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 2, pp. 191–200, 1925.

In this paper the author discusses the role of mycorrhizal fungi and reviews the work of former investigators, giving several examples which suggest that plants deprived of their endophytes may fail to blossom normally and are also more susceptible to the attack of parasitic fungi [see this *Review*, iii, p. 223].

A short summary is also given of the damage caused by parasitic fungi of the genus *Rhizoctonia* and of the analogies which certain of these fungi show to the orchid endophytes [see this *Review*, iv, pp. 380, 443].

HURSH (C. R.). **Sur la toxicité des milieux de cultures des champignons phytopathogènes vis-à-vis des plantes.** [On the toxicity to plants of culture media of phytopathogenic fungi.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 2, pp. 137–141, 1925.

After a brief discussion of the work done by other investigators on the nature of the substances produced by various parasitic fungi by means of which the host tissues are injured, the author describes his own experiments which indicate that too much

importance may be attached to the phenomenon of wilting of plants due to these toxic substances.

The fact that in his cultures of plants grown in the filtrate from liquid culture media in which the fungi were cultivated, the wilting disappeared when the plants were transferred from the filtrate to fresh water, indicates that it is due to a temporary loss of turgescence. These same plants replaced in the filtrate were observed to wilt either much more slowly or not at all. Freshly cut stems placed directly into the filtrate faded much more rapidly than those placed in fresh water for 24 hours previously. Others placed in a dilute solution of salts and sugar faded more slowly than in the fungous filtrate. Even before wilting commences it has been observed that wheat plants about to form ears absorbed seven times as much of fresh water as of a filtrate of *Leptosphaeria herpotrichoides*. If the water necessary for turgescence is considered to be the amount the plant will take up when placed in fresh water, it is probable that a seventh part of this would be insufficient to maintain turgidity. It would seem that the action of the filtrate is to incapacitate the vessels from functioning normally. Certain plants excrete at the cut stems pentosans which fill the ends of the vessels, and this excretion may be stimulated by the fungous filtrate. These plants wilt readily and are revived only with difficulty.

In general, wilting was most severe in culture liquids containing substances which are thermostable, dialysable, not precipitated by alcohol, and absorbed by animal charcoal.

Similar symptoms have been produced with cabbages grown in a filtrate of *Fusarium vasinfectum* or *F. oxysporum* as in those infected by the true vascular wilt fungus *F. conglutinans* in the field. It is suggested that the plant may attempt to get rid of the toxic substances by concentrating them in certain tissues such as the leaves, which turn yellow, dry up, and are got rid of by defoliation.

SIDERIS (C. P.). **The rôle of the hydrogen-ion concentration on the development of pigment in Fusaria.**—*Journ. Agric. Res.*, xxx, 11, pp. 1011–1019, 1 col. pl., 1925.

The results of the experiments described in this paper indicate that, in the case of practically all of the 15 named species of *Fusarium* tested, the production of pigment by these fungi is mainly controlled by the hydrogen-ion concentration of the culture media. In dextrose solutions whose initial P_H value was maintained constant by the addition of adjusting reagents [see this *Review*, iii, p. 673], pigment was almost invariably produced at concentrations between P_H 3·5 and 5·5, the optimum lying between P_H 4·0 and 5·0. Concentrations higher than P_H 3·0 or lower than P_H 7·0 inhibited the production of pigment. In cultures the initial hydrogen-ion concentration of which was not maintained constant, pigment was produced independently of the initial P_H value, this indicating that the organisms tend, by the secretion of metabolic products, to adjust the hydrogen-ion concentration of their culture media towards the optimum for pigment formation. At concentrations higher than, or near, that of the isometabolic point, the

majority of the pigments had a reddish-pink colour, while at concentrations lower than the isometabolic point they were of a purple, blue, yellow, or green colour. In solid culture media the movement of the hydrogen-ions and hydroxyl-ions released by the reaction of the metabolic products was very slow.

WALKER (LEVA B.) & ANDERSEN (EMMA N.).—**Relation of glycogen to spore-ejection.**—*Mycologia*, xvii, 4, pp. 154–159, 1 pl., 1925.

The authors describe in detail the mechanism of spore-ejection in three forms of *Sphaerobolus*, a genus which projects its spore masses farther than any other known fungus. On the ground of microchemical tests carried out by them they claim to have established that the forceful ejection of the spores in this genus is brought about by the sudden transformation into sugars, at a temperature of about 90° F. and in bright light, of the glycogen stored in the outer and inner peridial regions of the fructification. If a fruit body opens when the temperature is low and the light dim, the glycogen is transformed so slowly that no ejection occurs, and the spore mass is left in place.

The results of these experiments and observations on the occurrence of glycogen in the fructifications of other species lead the authors to believe that one of the primary functions of glycogen, when transformed into sugars, is to create an osmotic pressure which results in a sudden enlargement of cells in the vegetative tissues of fungi, and is, at least in many cases, the direct cause of the forceful ejection of spores in reproductive parts.

KOESLAG (J. D.). **Die Anerkennung von Frühkartoffeln in Holland.** [The certification of early Potatoes in Holland.]—*Deutsche Landw. Presse*, lii, 28, p. 341, 1925.

The principal early potato-growing districts of Holland are situated in the Berlikum district of Friesland (750 hect.) and the Streek and Langendijk regions of North Holland (5,250 hect.). The variety most extensively cultivated is the Eersteling or Schotsche Muis (Midlothian Early).

An account is given of the Dutch methods of cultivation and of the principles governing the certification of seed potatoes. The latter are classified as follows. Class A, containing not more than 1 per cent. combined leaf roll, mosaic, crinkle, stipple-streak, and verticilliosis, and 2 per cent. *Rhizoctonia* [*solani*] and gaps in the stand. Class B, containing not more than 1 per cent. combined leaf roll, mosaic, crinkle, stipple-streak, and verticilliosis (or containing 1 per cent. of these diseases, if not more than 0·5 per cent. is leaf roll), and 4 per cent. *Rhizoctonia*. Class C, containing 1 per cent. of these combined diseases (0·5 per cent. leaf roll) and 6 per cent. *Rhizoctonia*; or 2 per cent. of the combined diseases (1 per cent. leaf roll), and 4 per cent. *Rhizoctonia*; or 3 per cent. of the combined diseases (1 per cent. leaf roll) and 2 per cent. *Rhizoctonia*.

Of the 113·5 hect. inspected in Friesland in 1924, 89·44 were certified, of which 8·92 were placed in Class A. In North Holland 104·62 of the 156·90 hect. examined were certified and 36·29 placed in Class A.

Mann (H. H.) & Joshi (W. V.). **Further investigations on Potato cultivation in Western India. IV. Storage experiments with Potatoes.**—*Dept. of Agric., Bombay, Bull.* 121, pp. 17–25, 1925.

In section iv of this bulletin, the storage of seed potatoes in heaps outside and in the cold store is discussed in relation to *Fusarium* rot [see this *Review*, iii, p. 741] and loss by drying.

The results obtained in the experiments conducted in the Bombay Deccan with imported Italian varieties show that, when stored in heaps at an average shade temperature between 68° and 74° F., the loss of weight was low (2·1 per cent.), but the proportion of *Fusarium* rot was large (13·2 per cent.). At Poona, however, when a higher storage temperature was maintained (74° to 87°), the loss by rotting was reduced to 3·2 per cent. (chiefly dry rot), while the loss by drying was increased to 12·7 per cent. The problem of protection against both rot and excessive drying, therefore, is not yet solved.

The cold storage test carried out with British imported and Italian imported varieties kept for 9½ weeks at a temperature of 35° to 40°, and then gradually brought to a normal temperature (88°) by keeping at about 50° for 26 hours, showed a loss by rot limited to 0·5 per cent., and by drying of only 2 per cent. When removed from the cold store, germination occurred normally and no rotting was observed within 10 days after withdrawal from the store, though afterwards it developed rapidly. The British varieties were more liable to rot after cold storage than the Italian varieties.

The advantage of cold storage was confirmed in a subsequent test made with Scotch-grown Italian seed stored during the rainy season.

Dickson (B. T.). **Further studies on saltation in the organism causing 'black dot' disease of Potato.**—*Trans. Roy. Soc. Canada*, Sect. V, 3rd Ser., xix, pp. 275–277, 1 pl., 7 figs., 1925.

Further studies on the biology of the organism causing the black dot disease of potatoes (*Colletotrichum atramentarium*) [see this *Review*, iii, p. 228, iv, p. 699] have confirmed previous observations on the constancy of the saltant which originated in 1923. In none of the 35 generations which have developed since the last report has a sclerotium developed in the subcultures, nor has any change (except the darkening due to age) been observed in the coloration. The spores are always borne on conidiophores developed anywhere along the hyphae, and in no case have the conidiophores amalgamated to form an acervulus.

Each of the numerous conidiophores may apparently abstrict conidia repeatedly for some time: in one case 174 spores were observed to develop from 15 conidiophores. The spores are cadmium yellow (Ridgway's 'Color Standards') in the mass, compared with orange-pink or light salmon-orange in the normal form of *C. atramentarium*. The general culture colour of the latter varies from pink to pale rose-purple, while the saltant is aniline yellow to antique brown (same nomenclature).

On 21st February, 1924, a pathogenicity test was carried out on potatoes grown under controlled conditions with a series of *C. atramentarium* cultures from various sources. On 1st June it was found that the saltant had attacked the potato haulms weakly,

producing the typical amethystine tint on the stems [see also this *Review*, iv, p. 70], with scanty sclerotial development. Under natural conditions, therefore, the saltant may apparently revert to the original type.

Four other cultures of *C. atramentarium* from isolations made one to three years ago have developed saltants on oatmeal agar, the characters of which have so far been maintained.

ASHPLANT (H. T.). **Annual report for 1924–25.**—*Planters' Chron.*, xx, 27, pp. 440–444; 28, pp. 465–469, 1925.

The spraying operations to check the secondary leaf fall of *Hevea* rubber [caused by *Phytophthora meadii*] were continued in 1925 on a number of estates in South India, the success obtained in 1924 [see this *Review*, iv, p. 187] having led to a general adoption of the practice on the diseased areas of almost all estates. Some 10,000 acres in all were treated, but it is as yet too early to obtain details of the results. Trees sprayed in 1923 and 1924 were characterized by their vigorous leafy crowns and an increment in girth greater by half an inch than that of their unsprayed neighbours. It has been noticed that the Bordeaux mixture used in spraying does not adhere so well to the lower as to the upper surface of the leaves, and this was ascertained to be due to the fact that the cuticle of the lower surface is ridged, whereas that of the upper is flat. Air lodged between the ridges keeps the fluid from contact with the whole of the surface and causes the drops to run off. The midribs and petioles are smooth, which is fortunate in view of the preference of the *Phytophthora* for these parts.

Hevea rubber in South India is stated to be remarkably free from root diseases, that caused by *Ustulina zonata* being the only one of any importance. The attacks of *Ustulina* are usually associated with infections of patch canker [*Phytophthora* sp.] at the collar of the tree. The author, therefore, is opposed to the expenditure of large sums of money on clean clearing (i. e., the removal of stumps and fallen timber of jungle trees) in South India, except in such areas as have already proved to be exposed to danger from this source. As a rule, clean clearing is not worth doing at all, unless carried out before or during the first year after planting, and this is only necessary in some areas.

[This report is also reprinted in the *Bull. Rubber Growers' Assoc.*, vii, 9, pp. 545–554, 1925.]

STEVENS (H. P.). **Ageing tests on Rubber coagulated with acetic acid and paranitrophenol.**—*Bull. Rubber Growers' Assoc.*, vii, 8, pp. 496–498, 1925.

Further tests carried out by dissolving paranitrophenol in the acid used for coagulating the latex indicate that the minimum amount required to prevent mould growth on smoked sheet rubber [see this *Review*, iv, p. 189] is less than 0·03 per cent. of the latex or about 0·2 per cent. of the dry rubber produced.

The treatment was carried out on rubber estates in Malaya and, from the description supplied by Mr. Pinching, it appears that comparisons were made between samples of ordinary acetic acid coagulated rubber and others coagulated by a mixture of 5 oz.

acetic acid and 1·5 oz. paranitrophenol in 10 galls. water to each 30 galls. of latex standardized to $1\frac{3}{4}$ lb. dry rubber content per gall. This corresponds to a proportion of less than 0·03 per cent. paranitrophenol in the latex.

Freshly rolled sheet from both samples was dried and sprayed with water containing mould spores. Mould developed freely on the control samples, but none appeared on that treated with paranitrophenol.

The author repeated this test with fresh pieces cut from the sheets as received in London and obtained the same results. The advantage of dissolving the paranitrophenol in a dilute acid is emphasized, and should prevent all danger of its conversion into the less effective salts which are formed by this substance in the presence of lime.

VAN OVEREEM (C.). **Beiträge zur Pilzflora von Niederländisch Indien. II (No. 10–13). 13. Ueber den roten Wurzelpilz.** [Contribution to the fungus flora of the Dutch East Indies. II (No. 10–13). 13. On the red root fungus.]—*Bull. Jard. Bot. Buitenzorg*, Ser. III, vii, 4, pp. 436–443, 1 fig., 1925.

The author's and Steinmann's previous identification of *Fomes ferreus* with *F. pseudoferreus* [see this *Review*, iii, p. 423] and the use of the name *Ganoderma ferreum* (Berk.) v. Overeem and Steinmann for the fungus described by Miss Wakefield under the second of these names (*Kew Bull., 1918*, 6, p. 208) are stated to be incorrect. Subsequent investigation of material from Samoa, identified by Lloyd as *F. ferreus*, has enabled the author to come to the following conclusions. *F. ferreus* Berk. and *F. pseudoferreus* Wakef. are two distinct species. The Java red root fungus is certainly identical with that from the Straits Settlements known under the latter name [but see this *Review*, iv, p. 375]. The species belongs to the genus *Ganoderma* and should now be known as *G. pseudoferreum* (Wakef.) van Overeem et Steinmann nov. comb., with the following synonyms: *F. pseudoferreus* Wakef., *G. ferreum* v.O. & Stein. non *Fomes ferreus* Berk., ? *Poria hypobrunnea* Petch, ? *P. hypolateritia* Berk., and *Trametes theae* Zimm. A full description of the fungus is given.

The differences between *F. ferreus* and the red root fungus are discussed in some detail. The pores of *G. pseudoferreum* measure 95 to 160 μ (average 140 μ), compared with 60 to 75μ for *F. ferreus*. The pore walls of the latter are much thinner and the shape more angular. The two species can be readily differentiated by this character. The tissues of the pileus in both species are divergent both in colour and microscopic structure: the hyphae of *F. ferreus* are generally pale (often almost hyaline) and more slender than in the other.

The existing descriptions of the resupinate forms occurring in Ceylon and the Dutch East Indies are regarded as practically valueless owing to the great difference in the appearance of these fungi at various stages of development.

Sporophores of the red root fungus have been found in Java on living stems of *Metroxylon*, *Albizzia*, *Durio zibethinus*, and rubber (*Hevea brasiliensis*), and its mycelium on the roots of tea, cacao, *Cinnamomum*, and many other trees.

LANG (W.). **Der falsche Mehltau am Hopfen.** [Downy mildew of Hops.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, v, 8, pp. 63–64, 1925.

A brief account is given of the symptoms, life-history, and origin of downy mildew of hops (*Pseudoperonospora humuli*), a severe outbreak of which was reported from Württemberg in 1924. The hop-growing regions of Czecho-Slovakia and Alsace are now stated to be also affected. It is not thought that the disease has been imported on hop material for planting from abroad, since no introduction of the kind can be traced where it first appeared. The results of Salmon's and Ware's investigations on the disease in England [see this *Review*, iv, p. 566] are briefly summarized.

HALMA (F. F.) & FAWCETT (H. S.). **Relation of growth of Helminthosporium sacchari to maintained temperatures.**—*Phytopath.*, xv, 8, pp. 463–469, 3 graphs, 1925.

The material used in the writer's investigations of the temperature relations of *Helminthosporium sacchari* [see this *Review*, iv, p. 243] was obtained from H. A. Lee, of the Hawaiian Sugar Planters' Association. The fungus was grown in standard nutrient agar and in standard bouillon, the hydrogen-ion concentration of the latter being P_H 6·8. Eight different temperatures were maintained in the experiments by means of Livingston's and Fawcett's apparatus (see *Phytopath.*, x, p. 336, 1920), namely, 13·5°, 16·5°, 20·0°, 23·5°, 29·0°, 32·0°, and 36·0° C., each of which was tested on ten cultures on agar and ten in bouillon.

With the exception of 36°, the fungus was able to grow at all the temperatures maintained; even at 36° its development was only temporarily suspended, being rapidly resumed on removal to room temperature. The optimum temperature for development was found to lie between 20° and 29°, at which range the reaction of the bouillon became distinctly alkaline (P_H 8·0 to 8·2).

RAPSON (C. J.). **Control of streak disease in Uba Cane.**—*Proc. Third Ann. Congr. South African Sugar Assoc.*, pp. 10–12, 1925.

The author discusses the three stages of streak disease [see next abstract] observed on Uba canes in the field in South Africa, namely, complete infection, partial infection starting at the butt and gradually spreading to the rest of the shoot, and new infection caused by outside agents, generally confined to isolated shoots in an otherwise healthy stool. It is stated that latent infections resulting from the use of diseased 'seed' may not appear until the cane is three or four feet high.

The control measures recommended are based on roguing, the use of healthy seed cane, removal of old ratoons that are carrying the disease from the previous crop, and attention to the transmission of the disease by insects. Consistent roguing on the author's plantations has resulted in the almost complete elimination of this disease on hitherto heavily infected areas. When roguing, the whole of the setts from a shoot that gives rise to any diseased plants are removed: this is facilitated by cutting the setts after the original stem has been placed in the drill.

Storey (H. H.). **The year's progress in Cane disease investigations.**—*Proc. Third Ann. Congr. South African Sugar Assoc.*, pp. 13–14, 1925.

The main investigation carried out during the past year on streak disease of sugar-cane has been directed towards the determination of the nature and manner of its spread. A review of this work is given, the essential features of which have already been noticed [see above, p. 2].

[Following on this paper (pp. 14–16) is a summary of a discussion as to the symptoms and control of streak disease, in which various points of practical interest were brought out.]

Shepherd (E. F. S.). **Le 'streak disease' des Graminées à Maurice.** [The streak disease of Gramineae in Mauritius.]—*Rev. Agric. Île Maurice*, 22, pp. 540–542, 1925.

The appearance on R.P. 8 sugar-cane in Mauritius of a disease identical with streak disease [see last abstract] is recorded. Cuttings from the diseased plants, from apparently healthy shoots from diseased stools, and from healthy plants were planted, and two months later nine out of ten of the first-named exhibited the typical symptoms of streak, while the other two sets of cuttings remained free from infection. This indicates that the disease is transmitted by infected cuttings, as in Natal, and also that secondary infection in the field is relatively infrequent in Mauritius.

Subsequently the disease was observed on maize plants. Attempts to transmit it from infected to healthy individuals by an undetermined species of leaf-hopper gave negative results.

[This announcement was also published by H. H. Dodds in the *S. African Sugar Journ.*, ix, 9, p. 583, 1925.]

Bird (M.). **Soil hygiene in its relation to Cane 'disease'.**—*Intern. Sugar Journ.*, xxvii, 320, pp. 423–424; 322, pp. 536–537, 1925.

At the end of 1924, vigorous canes on several estates in the Berbice district of British Guiana began to wither at the top; growth appeared to cease and finally death ensued. The Colonial Mycologist concluded, after a thorough examination, that the cane was not diseased and suggested that a toxic condition of the soil, a grey clay, might be responsible for the damage [see also above, p. 3].

The writer's analyses of soils from the affected fields and of the ash of the juice from dead canes showed a considerable excess of magnesia over lime, a condition which is widely held to be detrimental to sugar-cane. The affected soils were extremely impermeable, and the increased demand for lime consequent upon the abnormally rapid growth of the canes which marked the 1924 season led to an excessive withdrawal of this element. On the death of the canes, the slow circulation of the soil water probably restored the lime-magnesia equilibrium, since the succeeding crop made vigorous growth.

If this explanation of the trouble be correct, the obvious safeguards against recurrence are such as will render the soil more porous, e.g., incorporation of vegetable matter, more thorough tillage, and the application of lime for the dual purpose of flocculat-

ing the soil and acting as a reserve in times of abnormally rapid growth. In fields where there was ample organic matter in the soil, withering did not occur.

Three 'epidemics' similar to that described above are stated to be on record for British Guiana, each one following a favourable season for cane growth.

McGeorge (W. T.). **The root rot problem of Sugar Cane.**—Reprinted from the *Proceedings of the Hawaiian Section of the American Chemical Society*, Honolulu, November 1, 1924, in *Facts about Sugar*, xx, 31, pp. 730–732, 1925.

The term 'root rot' of sugar-cane is here used as an extension of the older name 'Lahaina disease' [see this *Review*, iii, pp. 483, 484], which in Hawaii constitutes a general problem involving a number of phases of soil fertility. The failure to trace the etiology of this disease in the past is believed to be due to the assumption that some definite causal agent was at work, rather than a number of environmental factors, such as climatic conditions outside the range of adaptation of the plant or variety (H. 109, for instance, being totally unsuited to many Hawaiian localities); poor physical condition of the soil; the presence of toxic, soluble substances in the soil solution; conditions productive of abnormal or subnormal activity of soil micro-organisms; and plant food deficiencies or excess.

During the past few years the chemical department of the [Hawaii] Experiment Station has investigated the root rot problem along lines suggested by a knowledge of soil types, special attention having been given to acidity [see this *Review*, iv, p. 126].

The nodal accumulations of iron and aluminium described by Hoffer in connexion with his studies on root rot of maize [see this *Review*, iii, p. 32] are stated to be found also in sugar-cane. At the Royal Hungarian Institute of Plant Physiology similar data were obtained in the course of an investigation on root rot of sugar beets, in which an increase in aluminium content was uniformly found to precede invasion of the tissues by the causal organism [*Pythium de Baryanum*, *Phoma betae*, or *Aphanomyces levis*: see this *Review*, iii, p. 637].

Experiments are now in progress to test the value of various methods of correcting the aluminium toxicity of the soil. Applications of superphosphate at the rate of 20 tons per acre produced only a temporary response. Lime has given no immediate improvement but, as experiments conducted elsewhere have shown, only very slow progress can be expected from this form of treatment. Furthermore, the correction of aluminium toxicity may be only one factor in the solution of the root rot problem.

In conclusion the necessity of close co-operation between chemists and plant pathologists is emphasized.

Earle (F. S.). **Sugar Cane root diseases. The greatest cause of loss to the Cane growing industry—means of prevention.**—*Facts about Sugar*, xx, 37, p. 882, 1925.

Referring to McGeorge's paper on root rot of sugar-cane [see preceding abstract], the writer gives a brief outline of his views, based on twenty years' research, on the nature of this disease.

Many so-called cane diseases should really be regarded only as symptoms of root rot. Among these symptoms may be mentioned top rot, wither tip, rind disease [*Melanconium sacchari*], and (at any rate in some cases) red rot [*Colletotrichum falcatum*]. The actual destruction of the roots may be accomplished by any one of several facultative parasites, e.g., species of *Rhizoctonia* and *Pythium*.

Among the causes of the lowered vitality which predisposes the plant to the attacks of these fungi are the bad mechanical or chemical condition of the soil and the presence of other parasites or diseases, especially mosaic. In the writer's opinion, nine-tenths of the present losses from root diseases could easily be obviated by better cultural methods and greater care in varietal selection.

BURGWITZ (G. K.) & EREMEYEVA (Mme A. M.). Об отношении **Botrytis cinerea Pers.** к роду **Sclerotinia.** [On the relationship of *Botrytis cinerea* Pers. to the genus *Sclerotinia*.]—*Morbi Plantarum*, Leningrad, xiii, 3–4, pp. 102–111, 1924. [German summary. Received October, 1925.]

After a brief review of the literature on the genetic relationship of *Botrytis cinerea* to the genus *Sclerotinia*, the authors give a description of their attempts in 1924 to establish a genetic connexion between these organisms, using pure cultures of *B. cinerea* and of *S. libertiana* [*S. sclerotiorum*] collected from plants of *Solanum citrullifolium* badly attacked by both in the experimental greenhouse of the Phytopathological Section of the Chief Botanic Garden in Leningrad.

Under none of the conditions tested could *S. sclerotiorum* be induced to produce a conidial stage. Sclerotia allowed to overwinter on the host in the unheated greenhouse, and those produced on carrots in the laboratory (the latter after a rest period of two months), both gave rise to apothecia with ascospores, while on very rich nutrient media the sclerotia only produced a mycelium without forming apothecia. On the other hand, *B. cinerea* only formed sclerotia on all the culture media tested in the laboratory and under natural conditions on the host, and an ascospore stage could not be induced to develop.

Disinfection of Tobacco seed with formalin.—*Journ. Dept. Agric. S. Africa*, xi, 2, p. 121, 1925.

Attention is drawn to the advisability of disinfecting all tobacco seed before sowing on account of the danger of the introduction of the wildfire disease [*Bacterium tabacum*] into the seed-bed.

Soaking in a weak formalin solution (1 part of 40 per cent. commercial formalin to 16 parts water) for 15 minutes is recommended, followed by thorough washing and subsequent storage until sowing time in a place free from contamination with old tobacco leaf. If thoroughly washed, treated seed should remain good for at least three months.

LILLY (C. H.). **Mould spoilage in Tobacco.**—*Indust. Chem.*, i, 4, pp. 182–184, 1 fig., 1925.

The two most active agents of mould spoilage in fermenting

tobacco are stated to be *Aspergillus fumigatus* and *A. glaucus*, both of which are liable to reappear, under suitable temperature and humidity conditions, in the manufactured article.

A study of the possibilities of controlling this type of damage points to a more extended use of steam in the manufacturing processes, especially for the dark grades of tobacco. Moist heat at 92° to 97° C. is usually sufficient to kill the most resistant fungus spores in 5 to 10 minutes, while at 85° to 92° approximately half an hour is necessary to produce the same result. A temperature of 50°, such as is normally reached in the fermentation process, is stated to have little or no effect on the spores unless very prolonged. By incorporating with the steam supply 2 or 3 per cent. acetic acid, combined with the use of a special apparatus (British Patent No. 226,847 of 1923), it is claimed that sterilization can be effected in a few minutes at temperatures below 80° without affecting the colour of the material.

NAUMANN (A.). **Schädigungen der Tomatenpflanzen.** [Injuries of Tomato plants.]—*Die Kranke Pflanze*, ii, 9–10, pp. 195–198, 1925.

The following diseases of tomatoes are briefly described in popular terms and suitable control measures recommended. Wilt, due to *Rhizoctonia* [*solani*], *Fusarium lycopersici*, or *Sclerotinia* [*sclerotiorum*]; stem blight (*Diplodina lycopersici* = *Didymella lycopersici*) [see this *Review*, i, p. 150]; late blight (*Phytophthora infestans*); leaf spot (*Septoria lycopersici* var. *europaea* or *Mycosphaerella citrullina*); leaf mould (*Cladosporium fulvum*); fruit rot (*Phoma destructiva*); and the physiological disturbances, mosaic, leaf roll, and hollow stem.

BURGWITZ (G. K.). К вопросу о передаче ,, вершинной гнили" плодов Томатов, вызываемой **Bact. lycopersici.** [On the question of the transmission of the Tomato fruit 'blossom-end rot' caused by *Bact. lycopersici*.]—*Morbi Plantarum*, Leningrad, xiii, 3-4, pp. 128–130, 1924. [Received October, 1925.]

The author claims to have established by experiments in the spring of 1924 that *Bacterium lycopersici*, the cause of the blossom-end rot of tomato fruits described in a former paper [see this *Review*, iv, p. 318], may overwinter on tomato seed, without the latter losing its germinability. Plants raised from such seed developed normally and bore healthy fruit, but somewhat reduced in number as compared with the controls. Inoculation experiments by spraying the flowers, before their setting, with a two-day old culture of the organism on bean agar, gave positive results; the young fruits fell off shortly after setting and presented lesions typical of the disease, the causal organism being recovered from such lesions. The author believes, however, that this mode of infection does not occur frequently in nature, and inclines to the view that the disease is transmitted by insect agency.

SHAPOVALOV (M.). **High evaporation: a precursor and a concomitant of western yellow Tomato blight.**—*Phytopath.*, xv, 8, pp. 470–478, 6 graphs, 1925.

In connexion with his investigations on the correlation between

climatic factors and the distribution and severity of western yellow tomato blight [see this *Review*, iv, p. 639], the author cites a number of statistics to substantiate his claim that a combination of high temperature and low humidity is conducive to the development of the disease.

The summer of 1924 was marked by an unusually high evaporation in all those regions where western yellow blight occurred in an epidemic form. Reports from Utah show that the losses from this disease (30 to 35 per cent.) were heavier than in any year since 1905, while in Washington State 50 to 75 per cent. of the crop was affected. Similar conditions prevailed in Idaho. In California, where tomato cultivation is practised in widely contrasting localities, the amount of infection ranged from practically nil in the humid coastal regions to nearly 100 per cent. in districts with a high rate of evaporation. It is further regarded as significant that the first definite record of the occurrence of the disease east of the Rocky Mountains, in Kansas, was made in 1924.

During the most severe period of blight in 1924, the average monthly relative humidity in the affected areas appears (from a study of the local meteorological records) to have been below 35 per cent. as compared with over 50 per cent. in those which remained free from infection. The extremes for each group were found in the San Joaquin Valley of California for the former, and near Vancouver and San Diego for the latter. High evaporation is not only associated with, but also precedes, severe spells of blight, especially at the outset of the season.

When the evaporation rate drops to a low level for any length of time affected plants may show a partial recovery which is regarded as of considerable scientific interest, though of little practical value since the restoration is seldom complete. On the Riverside (California) experimental plots nearly 10 per cent. of the blighted plants showed partial recovery during August.

It is thought probable that evaporation has an important bearing on the diseases of many agricultural crops, and it is suggested that more meteorological stations should collect evaporation data in addition to those on other atmospheric factors.

BAUNACKE (W.). **Zum Blattrollen der Tomaten.** [The leaf roll of Tomatoes.]—*Die Kranke Pflanze*, ii, 9–10, pp. 204–205, 1925.

The writer attributes leaf roll of tomatoes exclusively to shortage of water during the critical period of growth. His tomatoes have shown no sign of the disease when interplanted with cucumbers on a ridge of garden soil above a trench 30 cm. in depth, three-quarters filled with fresh manure and the remaining quarter with compost. The foundation of manure ensures the rapid development of the plants and the cucumber foliage supplies the necessary shade and keeps the soil moist. When these measures were accidentally omitted the plants contracted the typical symptoms of leaf roll.

TOUMEY (J. W.) & LI (T. T.). **Nursery investigations with special reference to damping-off.**—*Yale Univ. School of Forestry Bull.* 10, 36 pp., 1924. [Received October, 1925.]

From April to September 1923, a series of investigations was

carried out at the Nursery of the Yale School of Forestry to determine an effective means of control of damping-off caused by *Pythium de Baryanum* and species of *Corticium* and *Fusarium* [see this *Review*, iii, p. 308] on white spruce (*Picea canadensis*), hemlock (*Tsuga canadensis*), and white pine (*Pinus strobus*). Special attention was paid to the effect of the soil disinfectants tested on the germination of the seedlings, the development of weeds, and the physical characteristics of the soil.

The experimental sandy loam beds, which measured 4 by 12 ft., were kept covered, either by boxes (beds 1 to 5) or by a mulch of leaves (6 to 10), previous to germination, when they were exposed to the air. Of the four agents recommended by Hartley [loc. cit.] for the control of damping-off, sulphuric acid and formaldehyde were selected as the most practical for general use. The sulphuric acid was applied to beds 1 to 5 at the rate of $\frac{6}{32}$ and $\frac{3}{32}$ fluid oz., and formalin (40 per cent. formaldehyde) to beds 6 to 10 at that of $\frac{6}{10}$ and $\frac{3}{10}$ fluid oz. per sq. ft. of seed-bed. The covering soil in all the beds receiving formalin was treated with the same agent at the rate of $\frac{6}{27}$ fluid oz. per cu. ft. of soil. The acid was applied to the beds immediately after sowing and the formalin a week before.

A survey of the seasonal weather data [which are presented in tabular form] shows that there were three periods of high temperature (maximum 90° to 95° F.) in June which were particularly favourable for excessive loss from the disease in question.

The application of sulphuric acid caused a marked change in the physical characteristics of the top soil, which became so compact that many of the seedlings were unable to penetrate it. This may be prevented by keeping the top soil thoroughly damp during the whole period of germination; or the beds may be rolled and the seed left uncovered on the surface. Sulphuric acid was found extremely effective in the eradication of weeds.

Germination was found to be accelerated by the application of formalin to the beds and retarded by that of sulphuric acid. Both treatments reduced the percentage of germination, but seeds of the same species gave higher germination values in the beds treated with acid than in those receiving formalin.

In the spruce and pine beds the effect of formalin was not clearly marked, but sulphuric acid reduced the damping-off. In the hemlock beds, where the controls showed a loss of 46·5 per cent., the effective results of both sanitation treatments were more evident; the losses in the plots receiving the light, heavy, and surface applications of formalin being 4·1, 2·4, and 24·3 per cent., respectively, while in the acid-treated beds they amounted only to 0·3 per cent. for the light application and nil for the heavy one.

There was a marked retardation of growth of the seedlings in the acid-treated beds, whereas the formalin treatment (especially the heavy applications) almost uniformly stimulated development. The acid treatment further caused a dwarfing of the whole root system. The weaker acid treatment, however, resulted in the highest number of surviving seedlings at the end of the season (1,310 of all species, compared with 1,031 in the control section and 459 in that receiving the weak formalin treatment).

DUFRÉNOY (J.). **Les tumeurs des résineux.** [The tumours of coniferous trees.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 2, pp. 102–112, 1925.

In the present paper a somewhat detailed *résumé* is given of the author's work on the tumours of coniferous trees which has been already noticed [see this *Review*, iv, p. 513].

GILL (L. S.). **Notes on sporophores of Polyporus schweinitzii Fr. on Yellow Pine in California.**—*Phytopath.*, xv, 8, pp. 492–493, 1925.

The heartwood of living yellow pine (*Pinus ponderosa*) is stated to be often affected with the brown carbonizing rot usually attributed to *Polyporus schweinitzii*, although in California positive identification is generally impossible owing to the rare conjunction of the fructifications with the decay, two additional cases of which, in the pine forests of the Sierra Nevada, are described. In one instance stipitate sporophores with a large round pileus were found at a distance of 5 ft. from the base. When the tree was felled, a continuous column of decay was found to extend through the bole for over 35 ft., rendering the first two 16 ft. saw logs worthless and reducing the value of the third. In the second case, the sporophores were not only emerging from the surface roots, but 12 or 14 more were growing out from a healed fire scar extending about 15 ft. from the ground.

It is thought probable that the sporophores only appear when wounds on the tree permit the mycelium to grow outwards from the heartwood.

BONDARTZEFF (A. S.). **Polyporus imberbis (Bull.) Fr., как паразит деревьев.** [*Polyporus imberbis* (Bull.) Fr. as a parasite of trees.]—*Morbi Plantarum*, Leningrad, xiii, 3–4, pp. 124–128, 1924. [German summary. Received October, 1925.]

A 75-year-old and about 17 m. high elm tree in the Chief Botanic Garden in Leningrad, which was blown down during the disastrous flood in September, 1924, was found to have been internally rotted, while still alive, by *Polyporus imberbis* (Bull.) Fr. (considered to be synonymous with *P. fumosus* (Pers.) Fr., and *P. holmiensis* Fr.). The rot extended from the base of the tree to 12 m. in height, involving the major portion of the heartwood but not penetrating the sapwood. It appeared to have originated in two wounds from broken branches situated at a height of 5·5 and 6·5 m. from the soil, where extensive cavities had formed, containing large accumulations of the sporophores, a detailed morphological description of which is given. Microscopical examination showed that the attacked wood was not uniformly rotted: among yellowish-white or almost colourless layers in strongly attacked wood, there existed weakly infected or even entirely healthy layers. The first to be destroyed were, apparently, the lignified elements of the medullary rays, the wood fibres resisting longer. All the large vessels, tracheids, and the wood parenchyma were permeated with hyaline, branching hyphae, from 2 to 3·2 μ in diameter and frequently provided with clamp-connexions. In the

small vessels, and when passing through the walls and pits, the hyphae were much more slender, averaging from 1 to 1·5 μ.

From this case and from the existing records of the occurrence of *Polyporus imberbis* on other trees in Russia [a list of which is given], the author is led to believe that this fungus is a not unimportant factor in the death of many trees.

Plant Diseases Law (Law 10 of 1925).—*Journ. Jamaica Agric. Soc.*, xxix, 7, pp. 267–280, 1925.

The Jamaica Plant Diseases Law has recently been revised and all the Orders under it are included in this paper. The only notifiable disease is Panama disease of bananas [*Fusarium cubense*], but three other plant diseases are legislated against as 'Infectious plant diseases'. They are the Bonnygate disease of bananas [*Sphaerostilbe musarum*], bud rot of coco-nuts [*Phytophthora palmivora*], and mosaic disease of sugar-cane. The prescribed measures against Panama disease are given in great detail [see also this *Review*, iii, pp. 64, 407; iv, p. 620]. They include the disinfection of the boots or feet of persons passing over infected land and of the implements used in removing diseased plants or in other operations; the cutting down and examination of the base of every banana plant within the radius of a chain from any diseased plant, and the treatment of the whole of the area within a chain from the nearest diseased plant by digging up all the plants and burning or liming all that are diseased and by liming and leaving exposed the holes; the removal and destruction *in situ* of all root crops within the area, which is then kept unplanted for at least a year and secure from entry by any person or animal; replanting can only be done under permission. The transport of banana plants or suckers from one parish to another is only permitted under licence. No banana leaves or trash may be used for wrapping anything moved by road or rail, except for packing bananas for transport to registered buying stations, where the wrappings are destroyed by fire.

Against the Bonnygate disease the measures provide that infected plants are dug up and limed after cutting into small pieces, and the holes are limed and left exposed, after which replanting is not permitted, nor may suckers be allowed to grow, for a period of three months.

Bud rot of coco-nuts must be treated by cutting down the palms and charring the tops by fire when the heart is affected, or by firing the expanded leaves when only the leaves are attacked. In the latter case the tree must be cut down if it does not put out healthy shoots within four months.

Sugar-cane mosaic in fields established before 15th December 1920 is treated by roguing where there is not more than 10 per cent. infection and the canes are less than four months old. Where there is more than 10 per cent. no cane can be used as 'seed' from the infected fields. In fields established since 15th December 1920 all infected plants less than four months old must be removed (but if there is more than 10 per cent. infection there may be an appeal to the Director of Agriculture) and no cane from infected fields may be used for planting.

The importation into the Island of citrus plants, buds, and grafts from any source is absolutely prohibited, with a view to preventing the introduction of citrus canker [*Pseudomonas citri*].

Regulations under the Importation of Plants Order, 1925, provide for fumigation at the Port of Kingston of plants from the United Kingdom or the United States and the admission of plants from other countries only under permit and inspection, with treatment if necessary.

Black scab in Potatoes.—*Third Ann. Rept. Min. of Agric. Northern Ireland, 1923–24*, pp. 78, 97–102, 1925.

On the whole, the provisions of the Orders in force for the prevention of the spread of potato wart (*Synchytrium endobioticum*) in Northern Ireland have been carefully observed. There is stated to be no doubt that the general planting of immune varieties (of which 17 are now approved by the Ministry) is the only adequate means of eradicating the disease. During the summer of 1924, 3,986 purity certificates were issued, covering some 11,000 acres in the scheduled area.

The regulations (Black scab in Potatoes (Northern Ireland) No. 2 Order, 22nd November, 1923) governing the movement of potatoes out of scheduled districts, a complete list of which is given, are cited and fully explained under the various headings.

Verordnung zur Abwehr der Einschleppung des Kartoffelkrebses. Vom 4. Juni 1925. [Order of 4th June 1925 for the prevention of the introduction of Potato wart.]—*Deutsche Obst- u. Gemüsebauzeit.*, lxxi, 33, p. 471, 1925.

On and after 1st July 1925 potatoes may only be imported into Germany through certain customs-stations where they will be subjected to an examination for freedom from wart disease (*Synchytrium endobioticum*). Such an examination may, at the discretion of the authorities, be dispensed with in cases where the consignments are accompanied by a certificate from an accredited official of the country of origin stating (*a*) that the potatoes have been examined and found free from wart disease, and (*b*) that they were grown in healthy soil, no infection being present within 500 m. of the field.

Regelung des Bezuges, der Abgabe und der Verwendung gifthaltiger Pflanzenschutzmittel. [Regulation concerning the purchase, delivery, and application of poisonous plant disinfectants.]—*Wiener Landw. Zeit.*, lxxv, 39, p. 329, 1925.

As from June 1925, certain amendments, destined to facilitate the purchase of a number of standard fungicides and insecticides in Austria, have been made in the decree of 21st April 1876, regulating commerce in chemical preparations containing toxic substances. These amendments (of which full particulars may be obtained at the Staatsdruckerei, Rennweg 12a, Wien III) are especially intended to help individual farmers, vintners, and others to obtain the necessary preparations without the complications and delays entailed by the former methods of procedure.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

VOL. V FEBRUARY 1926

White Pine blister rust.—*Ann. Rept. Massachusetts Dept. of Agric. for the year ending November 30, 1923*, pp. 31–32, 1924. [Received 1925.]

A brief account is given of the methods adopted for the control of white pine blister rust [*Cronartium ribicola*] in Massachusetts, where the disease was detected during 1923 in 20 additional towns, making a total of 144 infected to date. During the period under review, an area of 198,361 acres was examined at a cost of 12 cents per acre. The numbers of wild and cultivated *Ribes* removed were 1,558,107 and 14,887, respectively.

BLUMER (S.). **Die Perithecien des Eichenmehltaues (Microsphaera alphitoides Griff. et Maubl.).** [The perithecia of Oak mildew (*Microsphaera alphitoides* Griff. et Maubl.)]—*Mitt. Naturforsch. Gesellsch. Bern, 1924*, pp. xliv–xlvi, 1925.

This is an author's abstract of a paper read before the 49th meeting of the Berne Botanical Society in 1924.

During October, 1923, the perithecia of oak mildew were found in considerable abundance in the vicinity of Berne. In order to elucidate the systematic position of the fungus [see this *Review*, iii, p. 616], the perithecia of the oak mildew were compared with the forms of *Microsphaera alni* on *Alnus glutinosa* and *Viburnum opulus*. The measurement of 100 perithecia of each gave the following averages: *M.* on oak, 131 μ; *M. alni* on *Alnus*, 98 μ; *M. alni* on *Viburnum*, 93 μ. The corresponding number of appendages was 17, 10 to 12, and 6, respectively. A further distinction between the *Microsphaera* on oak and the other forms lies in the almost uniform occurrence of the former on the upper side of the leaf, while the latter are nearly always found on the under side. The very profuse conidial development of the oak *Microsphaera* constitutes another distinguishing character.

Pending a more exhaustive investigation of the collective species *M. alni*, the author prefers, on the basis of these differences, to consider the oak mildew as a separate species, for which the name *M. alphitoides* has precedence, though the conidial characters on which Griffon and Maublanc founded their diagnosis have been shown by Buchheim [loc. cit.] to be atypical.

into five categories according to their reaction to this type of damage. Among the excessively susceptible hardwoods may be mentioned *Acer pseudoplatanus*, *A. negundo*, *Aesculus glabra*, *Fraxinus*, *Rhus cotinus*, and *Sorbus*. Conifers included in a similar group are *Abies balsamea*, *A. pectinata*, *A. nordmanniana*, *A. insignis*, *Picea ajanensis*, *P. excelsa*, and *Pinus strobus*.

SEDLACZEK. **Holzkonservierung mit Quecksilberverbindungen.** [Timber preservation with mercury compounds.]—*Holzwelt*, xii, 35, pp. 13–16, 1925.

A brief account is given of the properties of mercury salts, with special reference to corrosive sublimate, and some of the more important patent and other processes devised to facilitate the impregnation of timber with these compounds are described and discussed [see also this *Review*, iv, p. 454].

Lead chloride may be mixed with corrosive sublimate in the ratio of 1 to 9 parts of the former to one of the latter, the resulting mixture being applied in solution at a strength of 1 to 2 per cent. The efficacy of this compound was strikingly demonstrated on *Merulius* [*lacrymans*]. Owing to its much greater solubility, zinc chloride may advantageously be substituted for lead chloride, or it may be combined with the latter. All such compound mixtures must contain at least 10 per cent. solid sublimate. Similarly, copper sulphate may be mixed with corrosive sublimate, with or without zinc chloride.

In order to obviate the corrosion of iron and other metal containers by sublimate solutions, the admixture of soluble silicates (100 parts water glass at 35° to 40° R. and 1 part of sublimate to 900 parts of water) has been recommended.

The tendency of corrosive sublimate to combine with proteids may be reduced by the admixture of fluorides, e. g., 9 parts of a 0·6 per cent. solution of sodium fluoride to 6·5 parts of a 0·6 per cent. solution of corrosive sublimate.

Metallic soap solutions, i. e., mercury resin soap dissolved in hydrocarbons, such as paraffin, anthracene, or mineral oil, tar, and the like, have been recommended as forming good protective coatings.

Other mercury compounds alleged to be suitable for timber preservation include hydroxymercuric acetic anhydride, hydroxymercuric benzoic anhydride, hydroxyphenylene mercuric oxide, hydroxyorthonitrophenylene mercuric oxide, mercurized orthoacetylaminophenol, and mercurized toluidine, which are soluble in aqueous, dilute ammonia. These products are dissolved in alkalies and applied at a strength of 0·1 to 1 per cent.

Blueing of timber, especially pine wood [caused by *Ceratostomella* spp.: see this *Review*, iv, p. 321], may be prevented by treatment with mercuric chloride alkali sulphide or other mercuric sulphide compounds.

MOLL (F.). **Neuere Untersuchungen über die Wirkung von Teeröl als Holzschutzmittel.** [Recent investigations on the action of coal-tar oil as a timber preservative.]—*Teer*, xxiii, 18, pp. 299–300, 1925.

Bateman's recent investigations on behalf of the American Wood

Preservers' Association in connexion with the action of coal-tar oil as a timber preservative are summarized.

The protective action of coal-tar oil is known to depend partially on the toxicity of certain constituents. It has been shown that the hydrocarbons are the most effective of these by reason both of their solubility and their specific toxicity. The latter factor was tested in every case on artificial cultures of wood-destroying fungi.

With the exception of normal hexane, in which the killing-point was reached at a saturated solution of 0·0013 per cent., the requisite concentration for the destruction of the organisms used in the tests exceeded 0·002 per cent. Hexane is extremely efficacious, but too volatile to be of any practical significance; it is at least ten times as toxic as benzole, but the latter is more than one hundred times as soluble in water as hexane. Naphthalene is soluble only to the extent of 0·003 per cent. in water, compared with 0·245 per cent. in a 2 per cent. pyridine solution. In one series of tests normal hexa-decane was used to reinforce solutions of pyridine, aniline, phenol, various alcohols, sodium oleate, &c., but neither solubility nor toxicity was thereby increased. Octane decreased the toxicity of alcohol. Purified petroleum oils were subjected to fractional distillation and intercepted every ten degrees, but none of the fractions suppressed the development of wood-destroying fungi. The lowest boiling oils were the most effective, but as a whole refined petroleum appears to be of little value as a timber preservative.

JONES (F. R.) & LINFORD (M. B.). **Pea disease survey in Wisconsin.**—*Wisconsin Agric. Exper. Stat. Res. Bull.* 64, pp. 1–31, 1 fig., 1 map, 5 graphs, 1925.

In this bulletin fuller details are given regarding the survey of pea diseases carried out in Wisconsin in 1924 [see this *Review*, iv, p. 646].

The disease chiefly dealt with is the root rot caused by *Aphanomyces euteiches*, which is assumed to be indigenous in Wisconsin soils, occurring especially in wet districts. The season of 1924, however, was cool and favourable for the development of peas, so that the damage to the crop was not so great as in previous years.

In some cases a newly observed 'wilt' disease was more destructive than *A. euteiches*, and this disease [the cause of which is not described] is considered to be the second in importance of those encountered. Losses were also caused by anthracnose (*Colletotrichum pisi*), which was the most injurious of the diseases damaging the foliage.

Other diseases noted but not causing important losses were: a new foot rot caused by a species of *Phoma*; seedling injury by *Rhizoctonia solani*; seedling and root injury by species of *Pythium*; leaf and pod spot (*Ascochyta pisi*); leaf blotch (*Septoria pisi*); leaf spot (*Septoria flagellifera*); downy mildew (*Peronospora viciae*); bacterial blight (*Pseudomonas pisi*); and mosaic.

Root rot was found in 32 per cent. of all fields examined, 11 per cent. being severely infected. The aggregate loss in the inspected

fields is estimated at 8 per cent. of the total yield, but since diseased fields were especially sought in the survey, it is believed that the loss on the pea crop as a whole was less than this figure.

The only commercial variety of pea actually growing in the surveyed area that showed an appreciable degree of resistance to root rot was the Green Admiral, and even this was greatly damaged when not planted early.

A five- or six-year rotation and the avoidance of poorly drained soil are suggested as methods of controlling root rot; but when continuous planting seems advisable a careful inspection of the fields will reveal the presence of the disease before it becomes destructive, and the land can then be rested.

SZEMBEL (S. J.). Антракноз Тыквенных растений (**Cucurbitaceae**) в Нижнем Поволжье. [Anthracnose of Cucurbitaceae in the Lower Volga region.]—*Comment. Inst. Astrachanensis ad defensionem plantarum*, i, 4, 16 pp., 2 figs., 1925.

The melon, watermelon, and cucumber growing industry [of considerable economic importance in the south of Russia] is stated to be seriously threatened in the Lower Volga basin by the increasing spread and virulence of anthracnose (*Colletotrichum lagenarium* (Pass.) Ellis et Halst., synonymous, according to the author, with *C. oligochaetum* Cav.). The disease is believed to have been introduced into the administrative district of Astrakhan with cantaloupe or watermelon seed between 1910 and 1912, since when it has spread over the whole of the Governments of Astrakhan and Tzaritzine and the Kalmuk Territory, frequently destroying the entire crop both in the field and under glass. The attribution in the Russian literature of a macroscopically similar disease of squashes (*Cucurbita pepo*) to the same organism is believed by the author to rest on a diagnostic error, as the specimen submitted to him was found to be affected with *Sporodesmium mucosum* Sacc. var. *pluriseptatum* Karst. et Har. [see this *Review*, ii, p. 535].

On the ground of local experience and personal experiments the author recommends, as control measures, a crop rotation of at least three years, and seed disinfection, the best results in the latter having been obtained with a 1 to 1,000 solution of corrosive sublimate. Spraying with Bordeaux mixture was found to be efficient only when the application was made very thoroughly, care being taken to spray both sides of the leaves and the stems, a process involving much labour.

DECKENBACH (K. N.). О мучнисторосяных грибах, паразитирующих на Тыквенных и Табаке на Южном берегу Крыма. [On mildew fungi parasitizing Cucurbitaceae and Tobacco on the south coast of the Crimea.]—*Morbi Plantarum*, Leningrad, xiii, 3–4, pp. 98–102, 1924. [Received October, 1925.]

In the Crimea the conidial stage of Cucurbitaceous mildew fungi is most common on cucumbers and the small variety of vegetable marrows, rarer on squashes, and still less frequent on melons; on watermelons it was only observed on the cotyledons of six-weeks-old seedlings, except once, in October, on a leaf of a watermelon plant in a garden when it occurred in the form of a

weakly developed mycelium bearing a few conidia. In addition to the eight cases enumerated in literature [a brief review of which is given] in which the ascospore stage of the fungi (*Erysiphe cichoracearum* and *Sphaerotheca* [*humuli* var.] *fuliginea*) were found on Cucurbitaceae, details are given of eighteen new records of this stage in various localities of the Crimea, perithecia of *S. fuliginea* being by far the more predominant on squashes, vegetable marrows, and melons; *E. cichoracearum* was not recorded on the latter host.

In view of the observation that, in the Crimea, plantations of tobacco growing in the vicinity of gardens with Cucurbitaceae infected with mildew usually suffer severely from attacks of *Oidium tabaci* Thüm. which, according to Salmon (*Mem. Torrey Bot. Club*, ix, 1900), is the conidial stage of *E. cichoracearum*, an attempt was made to establish through cross-inoculations whether the tobacco fungus is pathogenic to Cucurbitaceae. One-month-old seedlings of squashes, vegetable marrows, cucumbers, and melons reacted positively to infection with conidia of the tobacco organism, but in no case were perithecia formed on any of these hosts, neither are they known to occur on tobacco in Russia. On watermelon seedlings the results were inconclusive.

A further series of cross-inoculations showed that the mildew from melon (with perithecia of *S. fuliginea*) is equally pathogenic to squash, vegetable marrow, and cucumber, on which the ascospore stage also appeared. Watermelons inoculated with the same organism reproduced only the conidial stage.

Drechsler (C.). **The cottony leak of Cucumbers caused by Pythium aphanidermatum.**—*Journ. Agric. Res.*, xxx, 11, pp. 1035–1042, 2 pl., 1 fig., 1925.

Cucumbers (*Cucumis sativus*) grown in the south-east of the United States occasionally suffer not inconsiderable losses during transit to the northern markets, due to a decay for which the author suggests the name 'cottony leak' [see also next abstract]. The outstanding symptom is a luxuriant outgrowth of a cottony mycelial weft composed of non-septate hyphae, which entirely surrounds the fruit and is matted down, in places, into a wet membranous layer in which abundant oogonia with antheridia and oospores are found in all stages of development. The underlying tissues are water soaked, softened, and so lacking in mechanical firmness as to be readily divided with a blunt instrument; they also possess a peculiar, somewhat 'marshy' odour.

Pure cultures of the organism were practically indistinguishable, in their general appearance, from cultures of *Pythium de Baryanum*, with the only difference that, while in the latter the aerial mycelium generally fails to develop until the third day, in the former it develops in quantity, under suitable conditions, by the end of the second day. The morphological features [which are briefly described] of the reproductive apparatus of the cucumber fungus lead the author to consider that it corresponds to a fungus apparently first noted by E. J. Butler in India as a variety of *Pythium gracile* Schenk, parasitizing the roots and stems of ginger (*Zingiber officinale*) and the roots of castor (*Ricinus communis*).

Later, Subramaniam studied in India a fungus which he considered to be the same form, and differentiated it as a new species, *P. butleri*. In the meantime, it had been found in the United States as the cause of a disease of radishes and of sugar beet by Edson, who described it as *Rheosporangium aphanidermatum*, the type of a new genus of the Saprolegniaceae. The similarity and apparent identity of the American and Indian forms were pointed out by Carpenter, who found the fungus associated especially with a destructive root rot of sugar-cane in Hawaii. More recently Fitzpatrick made Carpenter's inferences effective in a taxonomic sense by combining Edson's specific name with both generic names *Pythium* and *Nematosporangium*, the resulting binomials being presented as alternatives, choice between which was made dependent on the advisability of retaining or abandoning Schroeter's genus *Nematosporangium* as distinct from *Pythium*. The author believes, however, that for the present the genus *Pythium* should be retained in its more inclusive sense, as employed by de Bary and Butler. The cucumber fungus is therefore identified as *Pythium aphanidermatum* (Eds.) Fitz.

Artificial inoculation experiments showed that, under favourable temperature and moisture conditions, the fungus is able to attack cucumbers both with injured and uninjured epidermis. That the parasite is not specialized was proved by successful infection experiments with strains morphologically identical with that from the cucumber but isolated from dead female nematodes (*Heterodera radicicola*), pea (*Pisum sativum*), and from watermelon fruits affected with the buff blossom-end rot. Besides cucumbers, the fungus was found to be strongly pathogenic for the patty-pan, vegetable marrow, and summer crookneck squash, all of which are varieties of *Cucurbita pepo*.

The sorting out of cucumbers affected by the fungus, and the lowering of humidity and temperature by adequate ventilation of the cars, combined possibly with refrigeration during transit, are indicated as means for controlling the disease.

DRECHSLER (C.). **Pythium infection of Cabbage heads.**—*Phytopath.*, xv, 8, pp. 482–485, 1 fig., 1925.

In 1924 the writer examined a cabbage head from the Washington market which showed a conspicuous water-soaking of the inner leaves, extending somewhat farther along the fleshy midribs than over the thinner lamellae, and evidently proceeding from the point of attachment between the modified foliar organs and the affected core. Superficially, the diseased portions of the leaves were nearly as firm to the touch as the healthy parts, but the deeper tissues were found to consist of a pulpy mass freely exuding water.

Microscopic examination of the diseased tissues revealed a profuse mycelium, and portions of the material planted on corn-meal agar yielded cultures of a species of *Pythium* of the *de Baryanum* type, the morphology and taxonomy of which will be fully discussed in a comparative account of the genus *Pythium* now in preparation. The sexual apparatus of the fungus is stated to show a marked divergence from that characteristic of *P. de Baryanum*, particularly in the relationship of antheridium to

oogonium. When the latter is intercalary and borne on the larger hyphae, fertilization is generally accomplished by cylindrical antheridia formed in the same hypha; while in the case of more delicate hyphae, a sessile, pouch-like outgrowth develops from the hypha in close proximity to the oogonium and functions as an antheridium, together with a small portion of the hypha delimited by a septum. Communication is established by a tube originating, in the former case, in the septum, and, in the latter, in the pouch-like part. Sometimes antheridia developing from a hypha other than that bearing the oogonium are observed, these being either of the 'branch' type with the septum at the base of an inflated part, or of a modified intercalary type, consisting of an intercalary portion of hypha bearing a sessile inflated protuberance from which the fertilization tube is produced, with two delimiting septa.

Inoculation experiments on healthy cabbage heads gave positive results, extensive water-soaking occurring within 24 hours, while a week after inoculation the infection had progressed into all the foliar elements composing the head for distances up to 60 mm. In the tissues of the fleshy midrib a watery condition results, not unlike that recently described as 'leak' and 'cottony leak' for diseases caused by congeneric forms in potatoes and cucumbers, respectively [see this *Review*, iii, p. 476, and preceding abstract]. The infected tissues exhale an odour somewhat resembling that of stewing cabbage.

A number of *Pythium* species of the *de Baryanum* type isolated from a variety of sources produced similar pathological effects on cabbage to those described above. Strains of *P. aphanidermatum* isolated from diseased watermelon and cucumbers affected by cottony leak also gave positive results. None of the species with spiny oogonia appears capable of infecting cabbage and the same is true of *P. monospermum*.

Tchoumakova (E. E.). К вопросу о способах борьбы с рассадочным грибком. [On the means of control of the seedling fungus.]—*Morbi Plantarum*, Leningrad, xiii, 3–4, pp. 121–123, 1924. [Received October, 1925.]

The results of a series of experiments made in 1924 with cabbage seedlings in pots to test P. Kyropoulos's recommendations (*Centralbl. für Bact.*, 2 Ab., xlv, p. 256, 1916) for the control of the seedling fungus, *Moniliopsis aderholdi* Ruhl., showed that by treating the infected soil with actively boiling water, the percentage of infection of the seedlings was reduced from 89 to 25 after one application, and from 45 to 14 and 0·7 after two and three applications. In no case was a full elimination of the pathogen attained, but the author points out that her experiments were made under exceptionally severe conditions, namely, a high degree on infection of the soil, excessive moisture, lack of aeration, insufficient light, and an abnormally dense stand of the seedlings.

The treatment of the soil with actively boiling water is, therefore, considered to be efficacious against the fungus in the case of pot cultures, and is also believed to be useful in seed-beds in greenhouses with the proviso that the superficial layers of the soil should not be stirred up after treatment.

Davis (W. H.). **Club-root of Chinese Cabbage.**—*Mycologia*, xvii, 4, pp. 160–162, 1 fig., 1925.

In October, 1923, a number of plants of Chinese cabbage, *Brassica pe-tsai* Bailey (stated to be of increasing commercial importance in the United States as a salad plant), growing in the vegetable garden of the Massachusetts Agricultural College, were found to present lesions typical of the club-root disease (*Plasmodiophora brassicae*). The diagnosis was confirmed by microscopical examination of sections of the diseased roots and by the morphological characteristics of the organism. Artificial infection of healthy seedlings by growing them in infected soil gave positive results. while the control plants apparently remained healthy.

From the author's observations and experiments it appears that all the Chinese varieties cultivated are hosts for *P. brassicae*.

Esmarch (F.). **Zur Kohlherniebekämpfung.** [On the control of club-root of Cabbage.]—*Die Kranke Pflanze*, ii, 9–10, pp. 207–208, 1925.

A series of tests in the control of club-root [*Plasmodiophora brassicae*] was carried out in 1925 on heavily infected soil planted with Dreienbrunner kohlrabi [*Brassica oleracea* var. *caulo-rapa*], The best results were given by uspulun dust, mixed with the soil at the rate of 1 to 2 gm. per plant hole, and Beka-Wurzelschutz, 1 in 9, applied as directed, which reduced the percentage of heavily and moderately severely infected plants from 98 to 0 and 5 per cent., respectively. The yields in the plots treated with these preparations were raised from 16·1 to 48·2 and 60·8 kg. per 7 sq. m. The results given by slaked lime and sulcun strewed on the soil at the rate of 10 and 1·75 kg. per 7 sq. m., respectively, three weeks before planting, and cyanide sulphur-lime dust, 10 gm. per plant hole, were less satisfactory, though probably sufficient for all practical purposes. Chloride of lime caused a heavy reduction of yield.

Jones (L. R.), Walker (J. C.), & Monteith Jr. (J.). **Fusarium resistant Cabbage: progress with second early varieties.**—*Journ. Agric. Res.*, xxx, 11, pp. 1027–1034, 2 pl., 1925.

After a brief reference to the destructive nature and wide distribution in the United States of the cabbage yellows disease (*Fusarium conglutinans*), and to previous work done in the selection of *Fusarium*-resistant winter and medium late varieties of cabbage, the authors describe in some detail their attempts from 1920 to 1923 to develop disease-resistant strains of the earlier varieties All Head Early and Copenhagen Market (Glory of Enkhuizen). While the work is not yet terminated, they have obtained two strains of the first-named variety which offer good promise of commercial value, as so far they have bred true to type and have shown a fairly high degree of resistance.

Severin (H. H. P.). **A natural breeding area of the Beet leafhopper (Eutettix tenella Baker) in the Sierra Nevada mountains.**—*Journ. Econ. Entom.*, xviii, 5, pp. 730–733, 1925.

The beet leafhopper (*Eutettix tenella*) [see this *Review*, iii, p.

537] has been found in four valleys in the Sierra Nevada mountains (California), a natural breeding ground occurring in Honey Lake Valley at an altitude of about 4,000 ft. The insects were found breeding on *Erodium cicutarium* growing in a sagebrush (*Artemisia tridentata*) area on the foothills. Early planting with reference to the spring and autumn dispersal of this insect [see next abstract] is stated to be of no practical value in these valleys as a means of checking the spread of curly leaf. There is no evidence to show that the adults migrate from the mountains into the Sacramento Valley.

SEVERIN (H. H. P.). **Percentage of curly leaf infection in Beet leafhopper (Eutettix tenella Baker) and winter host plants under field conditions.**—*Journ. Econ. Entom.*, xviii, 5, pp. 733–737, 1925.

The percentage of curly leaf developing in beet fields after the spring dispersal of the beet leafhopper (*Eutettix tenella*) from the plains and foothills of the Sierra Nevada [see preceding abstract] is stated to depend on the number of insects on each beet. Seventeen per cent. of the spring brood adults collected on the foothills of Little Pancche Valley in the San Joaquin Valley transmitted curly leaf to sugar beets under greenhouse conditions. One per cent. of the winter host, *Erodium cicutarium*, harboured curly leaf under natural conditions on the foothills of Little Panoche Valley. *Atriplex fruticosa* is also stated to be a natural winter host of the beet leafhopper.

CARSNER (E.). **Spring infection of Sugar-Beet leafhoppers with curly top virus.**—*U.S. Dept. of Agric. Official Record*, iv, 34, p. 3, 1925.

In the Yakima Valley of the State of Washington, where the losses from curly top [see preceding abstracts] have been extremely serious, approximately 25 per cent. only of the normal beet crop was harvested from a large acreage in 1924. In 1925 only three fields, comprising about 23 acres, were planted. In field (1) there were several rows of mother-beets, all affected with curly top, at one side of the field. In field (2), which was about 75 yards distant from (1), less disease was found than in the least affected part of (1). In field (3), which was about a quarter of a mile from (1), no curly top was observed. The relatively few leafhoppers were apparently equally distributed in all three fields. Probably they had developed on weeds which were not susceptible to curly top and therefore did not carry the virus of the disease.

MOULINOT (L. E. M.). **Remèdes préventifs contre la grise ou rouille du Céleri.** [Preventive measures against grey blight or rust of Celery.]—*Rev. Hort.*, xcvii, 20, pp. 491–492, 1925.

Directions are given for the control of celery rust (*Puccinia apii*), which is stated primarily to affect the French varieties Turc vert, Plein blanc de Paris, Pascal plein blanc, and Plein blanc doré Chemin, by the following cultural measures: special care as regards ventilation, &c., of seedlings grown in hot-beds for forcing; watering mature plants in the morning or at mid-day during September

and October in order to leave the foliage dry at night; and the cultivation of the above-mentioned susceptible varieties only in very rich soils and favourable situations. The use of a solution consisting of 2 gm. acetic acid per litre of water has been recommended in the case of plots already affected, but the writer prefers to rely on the means of prevention herein described.

GARDNER (M. W.). **Cladosporium spot of Cowpea.**—*Phytopath.*, xv, 8, pp. 453–462, 3 pl., 1925.

A full account is given of a disease of Early Buff cowpeas (*Vigna sinensis*) observed at Lafayette, Indiana, in August 1923 and 1924, which was found to be due to an undescribed species of *Cladosporium*, *C. vignae* n. sp., an English diagnosis of which is given.

The symptoms consist of dark purple or black, scabby spots, usually measuring 2 to 6 mm., on the pods; sunken purplish spots 1 to 3 mm. in length, on the peduncles and stems; and small, dark purple or maroon-bordered and tan-centred spots, measuring 0·5 to 1 mm., on the leaf blades. These lesions were generally smaller, darker, and more sharply defined than those of bacterial spot [*Bacterium vignae*: see this *Review*, ii, p. 485].

The causal organism was readily isolated from infected material and its pathogenicity proved in greenhouse inoculation tests [which are fully described] on 14 varieties of cowpea besides the Early Buff (the only one showing infection in the field), the Progressive White being very susceptible while Early Black, Taylor, and especially Arlington were resistant. Only the young, growing tissues were found to be susceptible to infection.

The fungus was shown to be transmitted by the seed, in which it may apparently persist from one season to the next.

DUCOMET (V.). **Plasmopara viticola sur Ampelopsis veitchii.** [*Plasmopara viticola* on *Ampelopsis veitchii*.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 2, pp. 129–130, 1925.

The occurrence of *Plasmopara viticola* on *Ampelopsis veitchii* was recorded in the Rhenish provinces in the autumn of 1924 [see this *Review*, iv, p. 205]. The author describes a similar case observed on a single two-year-old plant at Laugnac (Lot-et-Garonne) in September, 1924. He considers that this disease is, in all probability, not new on this host in Europe, but has merely escaped attention until recently.

ESMARCH (F.). **Bericht über den Ausflug in das Weinbaugebiet der Lössnitz am 22. August 1925.** [Report on the excursion to the Vine-growing district of the Lössnitz on 22nd August 1925.]—*Die Kranke Pflanze*, ii, 9–10, pp. 181–184, 1925.

The immersion of vine scions for three hours previous to grafting in solutions of uspulun up to 0·4 per cent. was found at the Viticultural Experimental and Training Institute, Hoflössnitz [Saxony], to have an extremely beneficial effect on their subsequent development.

The best control of *Oidium* [*Uncinula necator*] was given by spraying with 'Ventilato' sulphur (80° to 90° Chancel) [see this

Review, iii, p. 631]. As a rule two applications suffice: one when the shoots reach a hand's length and another after the blossom. In 1925, however, seven applications were necessary.

Peronospora [*Plasmopara viticola*] developed on unusual lines in 1925, infection occurring insidiously and sporadically until August instead of in sudden epidemics. The older leaves were attacked and showed an extensive desiccation of the tissues in place of the usual oil spots. In some cases the fruit was also affected. Spraying had to be carried out much more frequently than usual, in some cases twice a week.

HENGL (F.). **Vergleichende Versuche des Jahres 1924 gegen verschiedene Rebenschädlinge.** [Comparative experiments of the year 1924 in the control of various Vine pests.]—*Mitt. Bundesanst. für Pflanzenschutz, Wien II*, 4 pp., [1925].

The year 1924 was characterized in many parts of Austria by extremely severe attacks of 'roter Brenner' (*Pseudopeziza tracheiphila*) and downy mildew (*Peronospora* [*Plasmopara*] *viticola*) and was therefore eminently suitable for experiments in the control of these diseases [see also this *Review*, iii, p. 631].

Bordeaux mixture and Bosna paste, which are known to give good control in 2 per cent. concentrations, were also tested in two localities at 1 and 1·5 per cent. The former strength proved ineffectual, but there was no appreciable difference between the latter and the 2 per cent. solution. A German preparation known as 'C' was a complete failure both against roter Brenner and downy mildew. In a third locality, where the vineyards had been severely ravaged in 1923, the efficacy of a preventive spray of 2 per cent. Bordeaux mixture or Bosna paste on 20th May, followed by further regular applications, was strikingly demonstrated. A delay of even two days in the application of this critical spray led to serious results. The omission of the second application (30th May) resulted in heavy infection of the newly developed upper leaves, thus confirming previous observations as to the possibility of later attacks.

Excellent results in the control of downy mildew were given by three or four applications, beginning on 5th June, of 1·5 or 2 per cent. Bordeaux mixture or Bosna paste, even the 1 per cent. solutions of which were also quite satisfactory.

Nosperal (1 per cent.), kurtakol (0·75 per cent.), and two Hungarian dusts, P_1 and P_2 (1 and 2 per cent.) were less efficacious.

Preliminary tests were also carried out to test the value of magnesium sulphate as an admixture in Bordeaux mixture [see this *Review*, iii, pp. 220, 464]. Such additions, however, are obviously only of value if they effect a considerable reduction in the amount of copper used; this is hardly likely to be the case with downy mildew, three applications being the minimum for control whatever fungicide is used, owing to the constant development of fresh growth which has to be protected against infection.

Owing to the slight incidence of mildew (*Oidium tuckeri*) [*Uncinula necator*], no extensive tests in its control were possible. The results given by two new preparations, namely, sulikoll solid (Chemische Fabrik, Oderberg) and sukoll colloidal sulphur (Verein

für Chemische und Metallurgische Produktion, Karlsbad), were inadequate, but there was some indication that their efficacy would be increased at higher concentrations. 'C' again proved entirely useless. The applications of sulphur dust with the so-called Universalapparat Rebenschutz (Dir. Ing. Richard Weigl), to foliage already sprayed with Bordeaux mixture or Bosna paste, gave good results, especially where the leaves were still damp from the first treatment.

Kölliker (A.). **Die Ergebnisse der Prüfungen von Pflanzenschutzmitteln aus den Jahren 1921–1924.** [The results of the tests of plant disinfectants during the years 1921–1924.]—*Chem. Zeit.*, xlix, 94, pp. 654–655; 97, pp. 674–675; 100, pp. 700–701; 110, pp. 774–775; 112, pp. 790–792; 115, pp. 815–817, 1925.

The following fungicides were tested against vine mildew [*Plasmopara viticola*] during the period under review. Nosperal (Höchster Farbwerke) is stated to have been improved since the first trials in 1920, the present 1 per cent. solution being as efficacious as the former 1·3 per cent., and the 1·5 equal to the old 2 per cent. The preparation is a dark brown, readily soluble powder; the solution gives an acid reaction and requires the addition of lime. Three additional nosperal preparations (Nos. 629, 630, and 631) were supplied which contained the necessary admixture of lime; these grey powders produced dark olive-coloured, flocculent solutions which were well adapted for spraying purposes, the best results being given by 631. Excellent control was given by all these preparations, as well as by the ordinary brand of nosperal, which is said to be fully equal to Bordeaux mixture.

A neutral, very finely divided, copper-containing substance (No. 1,002) was also supplied by the Höchster Farbwerke. The dark brown powder, containing 0·7 per cent. copper, is readily soluble in water. This preparation gave very satisfactory results, as did also No. 1,002a.

Kurtakol 1923 (Chem. Fabrik Dr. K. Albert, Biebrich) consists, in its improved form, of a pale grey powder which gives a mixture with practically no tendency to settling and well adapted for spraying. Very good control was obtained by a first application at 1 and succeeding treatments at 1·5 per cent.

Kurtakol neu 80, kurtakol neu 30, kurtakol R, and kurtakol A contain an inorganic substance intended to increase their powers of adhesion. They are used, like kurtakol, at a strength of 750 gm. per 100 l. water. On the whole the results were satisfactory. Kurtakol dust, a yellowish-grey substance with sandy granules, proved unsatisfactory.

Omegan preparations 1 to 5, also supplied by Dr. K. Albert, are brown powders, the first containing no copper while the others are mixed with kurtakol and are stated to consist of metal oxides. The best results were given by omegan 5, but all the preparations were of some value. Omegan dusts 1 and 2 failed to control the disease.

Peronospora spray (Chem. Fabrik, Uerdingen) is a black powder which requires boiling before use with 3 to 5 times its volume of

water. The results of applications at 0·3 and 0·75 per cent. were unsatisfactory.

Copper dust No. 1,001 (formerly 516) (Höchster Farbwerke) gave very good results and merits further trial. No. 1,003 was somewhat less effectual.

Neuss dusts 1 and 2 (Dr. K. Albert) are pale grey powders, of which the former was ineffectual in a preliminary test while the latter protected the foliage but not the fruit.

Ciprin B dust (Chem. Fabrik E. de Haën, Seelze, Hanover), which proved the best of all those used in former trials, has been still further improved and gave excellent results.

A number of preparations for the control of *U. necator* are listed which could not be adequately tested in view of the almost complete absence of the fungus.

Nosprasen (Höchster Farbwerke) gave excellent combined control of *P. viticola* and eudemis [*Polychrosis botrana*].

SHARPLES (A.). **Annual Report of the Mycologist for 1924.**—*Malayan Agric. Journ.*, xiii, 7, pp. 214–219, 1925.

A reduction in the incidence of bark diseases of rubber has been observed in Malaya to result from alternate daily tapping. It has been found that daily tapping over a period greater than three months favours the development of fungi parasitic on the tapping cut.

Evidence is accumulating to show that the bud rot of the coconut and of the oil palm [*Elaeis guineensis*] in Malaya can be controlled by systematic treatment.

The term 'crown disease' is applied to the oil palm disease previously designated incipient bud rot [see this *Review*, iii, pp. 190, 445]. It has not, hitherto, proved fatal. Two coco-nut diseases sometimes confused with bud rot are briefly described. In the first, the stem tissues are soft and have a characteristic salmon-pink discoloration, with yellowish patches. No traces of known parasitic organisms have been found in the affected palms. In the second type, the stem tissues are hardened owing to lignification of the softer ground tissue elements, and the vascular bundles are reddish-brown. Several trees have recently been observed which show a combination of both these symptoms, and the possibility that there is only a single causal agent for both is being investigated.

A fruit disease of the oil palm, due to a fungus frequently found on the inside of the leaf bases, has recently been observed. The pinkish-white rhizomorphic strands of the fungus, on which a pink-capped *Marasmius*-like sporophore is often borne, grew up over the fruit bunches and severely injured them.

A bad attack of the root disease caused by *Fomes lignosus* was reported on patchouli (*Pogostemon* spp.) from Singapore.

Jerusalem artichokes were seriously damaged by a disease caused by the fungus *Sclerotium rolfsii*.

WELSFORD (Miss E. J.). **Report of the Government Mycologist for the year 1924.**—*Ann. Rept. Dept. Agric. Zanzibar*, 1924, p. 15, 1925.

The following references of phytopathological interest are con-

tained in this report, which deals only with the last four months of the year.

Coco-nut palms in Zanzibar have been attacked by *Diplodia epicocos*, *Pestalozzia palmarum*, and species of *Gloeosporium*, *Sphaeronema*, and *Fusarium*. The yield of nuts is low, partly on account of the excessive fall of the young nuts but chiefly on account of the gumming disease of the nuts. This disease, the cause of which is under investigation, is very widespread in the island and is stated to cause severe damage in Kenya [see this *Review*, v, p. 17] and Tanganyika also.

Other parasitic fungi reported include a species of *Triposporium* on sweet potato, *Septogloeum manihotis* on cassava [*Manihot utilissima*], *Gloeosporium musarum* on banana, *Kuehneola fici* and a species of *Trabutia* on fig.

MARTIN (G. H.). **Diseases of forest and shade trees, ornamental and miscellaneous plants in the United States in 1924.**—*Plant Disease Reporter*, *Supplement* 42, pp. 313–380, 1 map, 1925. [Mimeographed.]

This summary follows the same general plan as those of the preceding years [see this *Review*, iv, p. 526], but the bibliography is extended to include the principal recent literature in other countries besides America.

In the section on white pine (*Pinus strobus*) blister rust [*Cronartium ribicola*] control, prepared by J. F. Martin, the area cleared of currants and gooseberries in New England and New York in 1924 is stated to be over a million acres, more than 9½ million wild and cultivated *Ribes* having been destroyed.

An account is given by G. G. Hahn of the cedar blight caused by *Phomopsis juniperovora*. The smaller twigs turn brown and die, and then the disease may travel downwards to the older parts, producing cankers which completely girdle the stem or kill only one side of it. The fungus also causes a serious loss in the seedling beds, and as plants affected with blight are often not recognized, they have been widely disseminated. Besides *Juniperus virginiana* and other species of this genus, *Cupressus*, *Thuja*, *Retinospora*, and *Cryptomeria* are also attacked, whilst the disease has been produced artificially on *Larix decidua* and *Pseudotsuga douglasii*. Forms regarded as strains of *Phomopsis juniperovora* have been found on *Taxus baccata fastigiata*, *Cephalotaxus drupaceae*, and *Taxodium distichum*.

Chestnut blight (*Endothia parasitica*) is reported by A. F. Gravatt to be present probably in all the important chestnut-growing areas of the Southern Appalachians. The search for resistant varieties has yielded only a few trees, and these are not at all promising. The selection and propagation of trees which show signs of resistance is still proceeding.

Amongst the numerous records of other diseases the following may be mentioned. Leaf cast (*Hypodermella laricis*) of western larch (*Larix occidentalis*) occurred in British Columbia and was epidemic in young stands at Idaho. The shore pine (*Pinus contorta*) was also attacked by a species of *Hypodermella* in Wyoming and in Montana, where it was epidemic over a small area. A needle cast

of white pine (*Pinus strobus*) caused by *Hypoderma lineare* caused considerable defoliation on young trees in Pennsylvania.

Diplodia tubericola was reported to cause a canker of camphor (*Cinnamomum camphora*) in Texas.

Leaf spots of chestnut (*Castanea dentata*) were due to *Leptothyrium castaneae*, *Monochaetia pachyspora*, *Mycosphaerella maculiformis*, and *Scolecosporium fagi*.

A mosaic of elder (*Sambucus canadensis*) occurred in Pennsylvania and Florida, where it caused a stunting of the plants.

A twig disease of unknown origin is stated to be rapidly destroying elms along the Ohio River.

Amongst oak diseases, cankers caused by *Cytosporella paucispora*, *Septobasidium pedicillatum*, *Coryneum* (? *kunzei*), *Sphaeropsis quercina*, and *Strumella coryneoidea* are recorded.

Colletotrichum sp. caused a breaking-over of the leaf petioles of Royal palms (*Roystonea regia*) throughout Florida, and curly leaf, of unknown origin, produced a serious disease of the same palm, which eventually killed the plants attacked.

Yellows of china aster (*Callistephus chinensis*) [see this *Review*, v, p. 36] was very common in Arkansas, Indiana, Michigan, North and South Dakota, and Kansas. The losses were severe, in some cases all the plants being destroyed. A similar disease was widespread on *Erigeron canadensis*, and it is thought that this host may possibly serve as a source of infection, although no cross-inoculations were made. A mosaic of *Calendula* sp., very similar to aster yellows, occurred in Minnesota.

Irises were attacked by *Bacillus carotovorus*, *Cladochytrium tenue*, *Didymellina iridis*, *Pseudomonas iridis*, and *Septoria* sp.

A condition resembling a mosaic disease was found on rose leaves in two localities in Texas. A new blight of roses, associated with a fungus belonging to the *Polyspora-Protocoronospora* group [see this *Review*, iv, p. 129], has been reported from Maryland, Virginia, and North Carolina. It may cause a browning of the leaves and stems, or it may form irregular purple areas, one-quarter to more than one inch across, on the large green stems, sometimes with a longitudinal cracking of the bark. *Physalospora cydoniae* occurred, in the conidial stage, on rose bushes in Texas, and cross-inoculations indicated the identity of this organism with the fungus on the apple. *Botryosphaeria ribis* was reported on *Rosa* spp. in Maryland. Specimens of a rose canker collected in Cuba in 1924 were found to be associated by a species of *Stilbum*, probably the same fungus recorded by J. B. Rorer from Trinidad (see *Trinidad & Tobago Dept. Agric. Bull.* 18, p. 31, 1919).

Botany and plant pathology.—*Thirty-eighth Ann. Rept. Pennsylvania Agric. Exper. Stat. for the year ending June 30, 1925*, pp. 14–18, 2 figs., 1925.

Amongst the plant diseases on which work is in progress at the Pennsylvania Agricultural Experiment Station may be mentioned cabbage black leg [*Phoma lingam*] and club root [*Plasmodiophora brassicae*], apple blotch [*Phyllosticta solitaria*], and black rot [*Physalospora cydoniae*], and diseases of truck crops caused by *Sclerotinia* and *Botrytis*.

Observations indicate that the red spot disease of the leaves of the Lima bean [*Phaseolus lunatus*] is of parasitic origin. The spotting appears to be identical with that caused by *Bacterium viridifaciens* [see this *Review*, iii, p. 124].

The resetting of healthy rhubarb root cuttings without delay has resulted in practical freedom from crown rot [*Phytophthora cactorum*: see this *Review*, ii, p. 433]. Copper lime dust is recommended as a substitute for the Bordeaux liquid spray against this disease.

Brown (J. G.) & Gibson (F.). **Plant pathology.**—*Thirty-third Ann. Rept. Arizona Agric. Exper. Stat. for the year ended June 30, 1922*, pp. 238–248, 5 figs., [? 1925].

Experiments to test the effect of soil alkali on the susceptibility of Pima-Egyptian cotton to the black arm disease [*Bacterium malvacearum*] were commenced, treated and untreated, naturally infected seed being sown in various localities with differing soil types. Preliminary experiments showed that the treatment of the seed with concentrated sulphuric acid gave effective control of the disease and was superior to formaldehyde, corrosive sublimate, or hot water.

Although the same lot of heavily infected seed was used, no black arm appeared in the area in which the soil contained strong alkali, whereas in an area on alkali-free soil the crop was severely attacked, an examination of 273 plants showing 226 to be infected. It is thought that possibly the less succulent and more woody plants that grew in the former area were able to resist the infection.

Rot of date [*Phoenix dactylifera*] fruit [due to *Alternaria*, *Helminthosporium*, and *Macrosporium*: see this *Review*, ii, p. 154] was appreciably reduced by spraying twice, on 2nd April and 29th July, 1921, with 5–5–50 Bordeaux mixture. In 1922 the same spray and also self-boiled lime-sulphur gave similar results.

Co-operative spraying experiments with 4–6–50 Bordeaux mixture applied twice to different varieties of potatoes gave no evidence of beneficial results.

Amongst other diseases reported were a root rot of lucerne caused by *Fusarium* sp., leaf and boll spot of cotton caused by *Alternaria* sp., cotton rust (*Aecidium gossypii*); and a disease of chilli pepper due to a species of *Macrosporium*.

Rivera (V.). **Guarigione di alcuni cancri vegetali con la cura dei raggi X.** [The cure of plant cancers by means of X-rays.]—*Rendic. Accad. Lincei*, ii, Ser. 6, 3–4, pp. 142–144, 1 fig., 1925.

An account is given of the author's experiments carried out to test the effect of Röntgen rays on crown gall tumours produced experimentally in *Pelargonium zonatum* and *Ricinus communis*. The inoculations were made with cultures of *Bacterium tumefaciens* received from the Pasteur Institute, Paris.

In every case tested, it was found that the tumours receiving the rays ceased development some eight days after their application, turned yellowish and then brown, and appeared to die. Cicatrization tissue developed around the lesion, and the plant appeared to be completely cured. The control tumours on the same plant

which were protected from the rays by a sheet of lead, continued to develop. The rays do not injure the actual plant in any way, if applied with moderation, but more than two applications to the same part of the plant are risky.

Further tests showed that the rays have no effect on a pure culture of *Bact. tumefaciens* in peptone agar. Their action is, therefore, apparently confined to the tumour cells.

The rays, it is thought, immediately inhibit nuclear division and the proliferation of the cells, but this is not accompanied by an immediate cessation of tumour growth, since the individual tumour cells apparently undergo, for a time, an increase in diameter, without dividing. It even appears that this continued expansion of the cell contents, due probably to increased permeability of the membranes, is the cause of the eventual death of the tumour, since the walls of the tumour cells become lacerated as if ruptured by the pressure of their protoplasmic contents.

REICHERT. **Ueber die tumorerzeugende Bakterien.** [On the tumour-producing bacteria.]—*Zeitschr. für Krebsforsch.*, xxii, 5, pp. 446–449, 1925.

The ten bacterial strains isolated by Blumenthal and his collaborators [see this *Review*, iv, pp. 337, 530, 727] from malignant human and (in one case) canine tumours were each subjected to a bacteriological analysis in respect of their motility, Gram reaction, growth in various culture media, indol formation, agglutinability by sera, and the like.

The results of the analyses [which are presented in tabular form] are considered to show clearly that the strain known as P.M. corresponds in all particulars with *Bacillus* [*Bacterium*] *tumefaciens*, while eight of the remaining strains fall into three groups. One strain (Hübner) differed widely from all the others tested, showing close affinity with the *proteus* and *pyocyaneus* groups.

The interpretation of the fact that organisms so divergent (in a bacteriological sense) are all capable of tumour formation presents some difficulty. In the author's opinion (expressed in a lecture before the Verein für Natur und Heilkunde, Dresden, on 2nd March 1925), an ultramicroscopic virus attached to the bacteria is the true agent of the tumour formation. The recent work of Gye and Barnard [see this *Review*, iv, pp. 686, 687] is considered to support this view.

RIKER (A. J.) & KEITT (G. W.). **Crown gall in relation to nursery stock.**—*Science*, N.S., lxii, 1599, pp. 184–185, 1925.

In view of the existence of certain gaps in the knowledge of crown gall (*Bacterium tumefaciens*), investigations have been financed by the American Association of Nurserymen in co-operation with certain institutions. Amongst these investigations was an attempt to differentiate crown gall from other abnormalities apt to be confused with it.

Malformations resembling certain types of crown gall and hairy root were found at the union of apple root grafts made under aseptic conditions. Cultural and microscopic examinations failed to reveal the presence of *Bact. tumefaciens* in these overgrowths.

Other tests indicated that fresh callus on apple grafts is not usually a favourable site for the development of the crown gall organism. It would appear from these and other data that gall-like formations, other than injuries caused by organisms, are liable to develop on apple nursery stock.

Isolation and inoculation experiments are in progress on apple trees discarded at the nursery on account of malformations at the union. So far, the crown gall organism has not been found in any of the trees (over 175 from seven nurseries in four States). None of the malformations hitherto encountered in the rejected nursery stock was of the 'soft gall' type.

The most plausible hypothesis which can be advanced to explain these results is that the above-mentioned malformations were not induced by *Bact. tumefaciens*, but were merely incidental to the method of root grafting employed. They appear to have been associated with imperfect unions and the consequent disorganization of the water and food supply.

BUNTING (R. H.) & COULL (R.). **Minutes by the Government Mycologist and Agricultural Chemist to the Director of Agriculture, dated 2nd January, 1925.**—*Journ. Gold Coast Agric. & Comm. Soc.*, iv, 1, pp. 77–78, 1925.

Cocoa beans [the seeds of *Theobroma cacao*] received from various localities in the Gold Coast were found to show white spots visible as soon as the skin was removed. These spots were at first thought to be due to moulds, but on examination were found to be largely deposits of cocoa fat. It is considered that they are due to rapid evaporation caused by the unusually dry atmospheric conditions prevalent during the preparation of the produce in the previous dry season, and that they are not likely to result in any deterioration of the produce.

COULL (R.). **Preliminary attempts to reproduce the conditions causing white spot on Cocoa.**—*Journ. Gold Coast Agric. & Comm. Soc.*, iv, 2, p. 143, 1925.

Attempts have been made to reproduce under laboratory conditions the white spots on cocoa beans previously reported from the Gold Coast [see last abstract].

When fresh beans were placed in an air-tight apparatus, and a current of dry air aspirated over them at laboratory temperature, further drying being secured by placing sulphuric acid in the apparatus and by subsequent sun-drying, characteristic spots, similar to those previously observed, developed. This experiment is considered to show that the previous deduction as to the cause of the spots is correct.

NEILL (J. C.). **Loose smut of Wheat. III. A comparison in germination and percentage infection between 'firsts' and 'seconds' seed.**—*New Zealand Journ. of Agric.*, xxxi, 3, pp. 161–163, 1925.

The author has continued his investigations on loose smut (*Ustilago tritici*) of wheat [see this *Review*, iv, p. 532], and in the present paper records the results of experiments which indicate clearly

that no reliance should be placed on seed grading as a means of controlling loose smut.

Samples of grain of Major wheat, separated into 'firsts' (large) and 'seconds' (small) by passing through a sieve with rectangular perforations 2·5 by 12 mm. in diameter, were pre-soaked for 6 hours, maintaining a temperature of 84° F., followed by dipping for 10 minutes in water at 127° and air drying at 90°. Similar samples were left untreated. The results [which are presented in tabular form] showed that in the laboratory experiments with untreated seed, the 'seconds' germinated more vigorously than the 'firsts', while after treatment the reverse was the case. The percentage of germination was nearly the same throughout. In the field the 'firsts' showed the higher percentage of germination in both treated and untreated seed, and disinfection, while completely eliminating smut in both, reduced germination most in the 'seconds'. In the untreated seed there was a slightly higher percentage of smut in the 'seconds' than in the 'firsts'.

Hauptversammlung des Vereins Deutscher Chemiker in Nürnberg vom 1 bis 5 September 1925. [The General Congress of the German Chemists' Union held at Nuremberg from 1st to 5th September 1925.]—*Chem. Zeit.*, xlix, 109, pp. 766–771, and subsequent numbers, 1925.

The opening paper at the recent Congress of the German Chemists' Union, dealing with the control of cereal diseases by chemical methods, was read by Prof. Klages of Magdeburg.

Some striking statistics of the losses caused by fungous diseases were cited. For instance, the average loss in Saxony during a 'normal' bunt [*Tilletia tritici* and *T. levis*] year is estimated at Mk. 6,500,000, while 12·76 per cent. of the area under rye in Prussia alone had to be ploughed up in 1924 on account of *Fusarium* [*Calonectria graminicola*] infection. It is calculated that if the 1·7 million cwt. of seed used to cover this area had been disinfected, the resulting increase of yield would have represented a value of Mk. 159,250,000.

The possibility of introducing legislation to enforce the adoption of protective measures was discussed. Such measures are stated to have been nominally in force in Württemberg and Brunswick since 1917, though they have not yet assumed any practical importance.

An account was given of the various methods of seed treatment, with special reference to mercurial preparations, and the functions of the Biologische Reichsanstalt in connexion with the testing of fungicides were defined. Allusion was also made to some form of legislation for controlling 'secret remedies' in plant protection.

The remainder of the papers dealt with other branches of chemistry.

[A report of the proceedings of this Congress also appeared in *Zeitschr. für Angewandte Chemie*, xxxviii, 37, pp. 789–851, 1925.]

McKinney (H. H.). **A mosaic disease of winter Wheat and winter Rye.**—*U.S. Dept. of Agric. Bull.* 1361, 10 pp., 4 figs., 1925.

This paper deals with the mosaic disease which was stated in

previous papers [see this *Review*, iii, pp. 84, 452, and iv, p. 662] to be associated with the rosette disease of winter wheat. At first, it was not considered to be a true mosaic, as there were indications that the mottling of the leaves bore some relation to the soil, but subsequent investigations indicate that both the mottling and the rosette conditions are manifestations of one and the same transmissible mosaic disease. The geographical distribution of both forms in Illinois and Indiana is discussed, and the statement is made that winter rye growing as a cover crop at the Arlington Experiment Farm, Virginia, was found to be affected with what appears to be the same mosaic.

The disease apparently gives rise both on winter wheat and on winter rye to all the symptoms associated with the mosaics on other Gramineae, including mottlings of the leaves [a detailed description of which is given]. As in many other mosaic diseases, dwarfing and excessive proliferation of the plants are caused in certain varieties; this condition was formerly described as rosette, and is especially severe in Harvest Queen (also known as Red Cross and Salzer's Prize-taker) and several other varieties listed in the previous accounts. The leaves of rosetted plants eventually become dark green in colour, thus masking the mosaic mottling, but the previously described cell inclusions were always found when the plants were examined. Also when such plants produced new tillers, mosaic was found to occur on the new leaves of the latter before the dark green coloration developed.

A leaf mottling is also described which must not be confused with mosaic, and which appears to be due to faulty nutrition of the plants. The chief differences between the two consist in the different disposition and shape of the mottlings and in their colour; in severe mosaic the chlorotic areas are usually lemon-yellow or faded yellow, whereas in the other case the chlorotic areas tend towards an orange colour. Cell inclusions were not found in the leaves showing the latter condition.

Details are given of six successful artificial wound inoculations with juice and pulp from diseased plants on named varieties of wheat and of winter rye, and further studies are in course to determine the influence of environmental factors on the host and on the disease.

Experiments have shown that the causal agent of this disease persists in fine river silt soils for at least six years, while field observations appear to indicate that it does not persist quite so long in sandy soils. Besides the experiments described in previous reports, further tests with infested soil have shown that susceptible varieties grown in it always become more or less infected unless the soil is first sterilized by steam or formaldehyde.

DURRELL (L. W.). **Basisporium dry rot of Corn.**—*Iowa Agric. Exper. Stat. Res. Bull.* 84, pp. 139–160, 12 figs., 1925.

Maize crops in the State of Iowa are reported to have been severely attacked in 1923, and still more in 1924, by a disease for which the name *Basisporium* dry rot is suggested, to distinguish it from other similar rots caused by *Diplodia zeae* and *Gibberella*

saubinetii. The causal organism was identified as *Basisporium gallarum* Moll. [see also this *Review*, ii, p. 296], and from a comparison of specimens, descriptions, and published figures, the author considers it to be identical with the Bulgarian maize fungus *Coniosporium gecevi* Bubák.

The organism causes a dry rot of the shanks [ear stalks], husks, and stalks of maize, and may be readily recognized in the field by the presence, on the affected parts, of agglomerations of its black spores that give to the surfaces on which they are borne a powdery black or blackish-grey appearance. The ear stalk is usually retted, so that the vascular bundles appear like the strands of a rope, and is so weakened that the ears readily snap off at harvest time. It also attacks the ears, where it grows on the cob and over the base of the grains, giving them the same black or greyish appearance above mentioned. The mycelium is sparse and inconspicuous on the surface, but it occurs very abundantly in the tissues of the cob and often in the furrows between the rows of grain. The butt end of the cob also shows the same characteristic retting as the ear stalk. The grains are affected in varying degree, some only slightly, while in others the embryo is killed.

On the host plant the fungus is characterized by a sparse, white mycelium, bearing black, subspherical spores on basidium-like sporophores. The spores average 13 to 18 μ in diameter and possess a thick, black exospore which, when broken, allows the exit of a thin, light-coloured endospore. On germination, two germ-tubes are usually sent out, not a single bifurcated tube as described by Molliard. The spores germinate with difficulty in water; their germination is greatly stimulated, however, by the presence, either in the water, or even in the germination chamber, of vegetable tissue. On the ground of his experiments [a brief description of which is given] the author considers that this stimulation of the germinative power of the spores is due to the carbon dioxide produced by the plant tissues. The maximum, optimum, and minimum temperatures for spore germination are 35°, 25°, and 15° C. respectively. The optimum temperature for mycelial growth is 25°, while growth is inhibited at temperatures below 10° or above 40° C. Sporulation may take place between 20° and 35° C. The fungus readily overwinters in its conidial stage.

B. gallarum grows well on a wide range of media, especially on those rich in nitrogenous substances. On the maize grain it destroys the embryo before the starchy endosperm.

The damage done to the maize crop, which in 1923 varied in the State of Iowa from 9·1 to 50 or 60 per cent. in some fields, consists chiefly in the reduction of the yield and of the quality of the grain, and also in a marked reduction of the stands, maize being most susceptible to attack during the time of germination of the seed and at the late stages of maturity. Inoculations on the growing roots and stalks gave negative results. A study of the environmental factors showed that heavy precipitation in August and September, when the crop is maturing, favours the development of the disease. In 1923 early varieties of maize became generally infected, while late varieties escaped the infection. The disease does not spread readily in maize ears stored in bins.

REED (G. M.) & MELCHERS (L. E.). **Sorghum smuts and varietal resistance in Sorghums.**—*U.S. Dept. of Agric. Bull.* 1284, 56 pp., 10 pl., 1925.

The investigations described in the present paper were undertaken primarily to determine the varietal resistance of sorghum to kernel smut (*Sphacelotheca sorghi*) [see this *Review*, iii, p. 85]. The experiments were conducted at Columbia, Missouri, from 1915 to 1918; Manhattan, Kansas, from 1916 to 1921; Amarillo, Texas, from 1916 to 1919; Arlington, Virginia, in 1920; and Brooklyn, New York, in 1921. At Amarillo observations were also made on varietal susceptibility to *Sorosporium reilianum*. The results are presented in tabular form, besides being fully discussed in the text.

All the strains of Shallu used in the tests proved very susceptible to kernel smut, 27·6 per cent. of the total number of plants grown at Columbia being infected. The Sorgos or sweet sorghums were also generally susceptible, some of the highest infection percentages (frequently running above 40) being obtained in the Black Amber group. The Red Amber, Orange, and Sumac groups, two Java varieties, and White African, also showed heavy infection, while Gooseneck and Honey proved comparatively resistant. Sudan grass [*Andropogon sorghum-sudanensis*] and broom corn were susceptible and the Kafirs extremely so. Thirty-five per cent. of eight strains of Blackhull Kafir grown at Columbia contracted the disease, the corresponding figures for two strains of Pink being 62·3 and 32·7 per cent., and for four strains of Red, 27·7 per cent. The average infection on a strain of Brown Durra grown at Columbia was 45 per cent. The commonly cultivated White Durra was also somewhat susceptible, but a few recent introductions of this type have shown a high degree of resistance. Shantung, a dwarf brown Kaoliang, was extremely resistant. The Barchet, Blackhull, Manchu, and Mukden White are susceptible. The four varieties of Milo proved remarkably resistant, not a single case of infection occurring among the 4,529 plants of Dwarf Yellow, 2,074 of Standard Yellow, and 144 of Dwarf White, while only three out of 2,256 Standard White plants contracted the disease. Similarly, only seven out of 3,638 Feterita plants showed signs of infection. Of the miscellaneous sorghums tested, the hybrid broom corns and Schrock sorghum were very susceptible, Freed sorghum and Husserita somewhat less so, while Darso, Dwarf Hegari, and Sudan corn exhibited a high degree of resistance.

Environmental conditions were found to play an important part in the incidence of kernel smut infection. The low percentages of infection obtained at Columbia in 1918 are thought to have been correlated with the high temperature and low precipitation preceding and following the sowing of the grain. There appears to be no correlation between the rate of germination of sorghum plants and their susceptibility to kernel smut [see this *Review*, iv, p. 344].

At Amarillo observations indicated that the sorghums, as a whole, are less susceptible to *Sorosporium reilianum* than to *Sphacelotheca sorghi*. Marked susceptibility was shown only by Brown and White Durra, Black, Red, and Minnesota Amber Sorgo, Colman and Early Rose Sorgo, and Schrock sorghum.

A bibliography of 120 titles is appended.

CARNE (W. M.). **Citrus brown rot.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., ii, 3, p. 359, 1925.

Experiments conducted in Western Australia during 1925 have demonstrated in a remarkable way the effectiveness of copper sprays in preventing brown rot and leaf blight of citrus [*Phytophthora* sp.: see this *Review*, iv, p. 277].

In one orchard, the disease continued for about ten days after spraying (which was delayed until after the first rains) and then practically ceased, whilst adjoining orchards remained all more or less affected. Two other cases of effective control by spraying are cited, and in a fourth instance, when spraying was carried out in June, one tree which was left unsprayed lost about half of its leaves and nearly all its fruit, whilst only slight traces of disease could be found on the sprayed trees.

Both Bordeaux (4–4–50) and Burgundy (4–6–50) mixtures were used with equal effect. It is recommended that applications should be made not later than the end of April, viz., before the autumn rains commence, and that the trees be thoroughly sprayed to about breast high, a practice which allows the beneficial entomogenous fungi to persist.

ASHBY (S. F.). **Withertip and blossom blight of Limes.**—*Proc. Ninth West Indian Agric. Conf., 1924*, pp. 172–174, 1925.

The recent outbreak of the wither-tip disease of limes (attributed in Florida to a form of *Colletotrichum gloeosporioides* but in California regarded as due to a distinct species, *Gloeosporium limetticolum*) in Dominica has already been noticed [see this *Review*, iv, p. 215]. The author states that the fungus in Dominica and Trinidad does not conform fully with Clausen's description of *G. limetticolum*, which is probably too restricted. He describes the distribution of the disease in the West Indian region and refers to the reduction of about 40 per cent., caused largely by it, in the main crop of Dominica in 1922–1923. The characteristic symptoms are described in detail. The advisability of replacing the susceptible West Indian lime with highly resistant or immune kinds is emphasized [see this *Review*, iv, p. 666]. A number of these, obtained from the United States, are now being raised at the Botanic Station, Dominica. Control by spraying, which has proved fairly satisfactory in Florida, is considered to be impracticable in this island on account of economic and other local conditions.

WALTERS (E. A.). **Die-back of Limes (Citrus medica var. acida).**—*Proc. Ninth West Indian Agric. Conf., 1924*, pp. 232–234, 1925.

In this paper the author records observations made during 1923 as to the causes of a die-back of lime trees in Saint Lucia, West Indies [see also this *Review*, iii, p. 268]. Almost without exception this condition, which is characterized by yellowing and falling of the leaves, casting of fruit, browning of the young tips of the branches, and subsequent extension to a main branch, which dries up, is associated with poor soil. No trace of wither-tip [see last abstract] or other parasitic diseases has been observed and a re-

markable recovery has been brought about by deep digging and the application of humus, combined with adequate spraying against insects and pruning of the dead branches. The fact that this recovery may be effected before the commencement of the rainy season indicates that it is due to an improvement in the physiological functions of the tree, not dependent on meteorological conditions.

It has been observed that *Casuarina* trees, planted as wind breaks near the lime plantations, have a decidedly ill effect on the health of the limes, probably on account of the restriction of the water supply effected by the absorptive power of the roots of this tree.

STEVENS (N. E.). **The life history and relationships of Diplodia gossypina.**—*Mycologia*, xvii, 5, pp. 191–201, 1 pl., 1925.

Further study of the species of *Botryosphaeria* and *Physalospora* [see this *Review*, iv, p. 636] has shown that the perfect stage of *Diplodia gossypina*, the cause of a boll rot of cotton, is a *Physalospora* closely related to *P. malorum* [*P. cydoniae*]. It is provisionally named *P. gossypina*, and is distinguished from *P. cydoniae* by its slightly larger perithecia (294 by 245 μ) and ascopores (24 to 42 by 7 to 17 μ). The pycnospores measure 17 to 35 by 9 to 23 μ, as compared with 17 to 32 by 7 to 15 μ for *P. cydoniae*, and they rarely become coloured in the pycnidium until ready for discharge, by which time they are usually septate. The pycnidial stage cannot be distinguished from *D. natalensis* on morphological grounds, but the latter is able to grow at higher temperatures.

The *Botryosphaeria* on cotton tentatively referred to *B. fuliginosa* by Edgerton (*Mycologia*, iv, p. 34, 1912) is considered to be identical with *B. ribis*. The name *B. fuliginosa* as used by Ellis and Everhart includes species of both *Botryosphaeria* and *Physalospora*, and was apparently never valid for any of these fungi.

There is stated to be as yet no evidence that the species of *Diplodia* common in the south-eastern United States are limited to certain hosts, but rather that they pass readily from one host to another.

LEHMAN (S. G.). **Studies on treatment of Cotton seed.**—*North Carolina Agric. Exper. Stat. Tech. Bull.* 26, 71 pp., 4 figs., 5 diags., 1 graph, 1925.

This is a very detailed account of the author's investigations, instituted in 1920, on the control of cotton anthracnose (*Glomerella gossypii*), which in 1923 caused an estimated loss of 36,000 bales in North Carolina alone, by seed treatment.

The experiments were commenced with seed of the 1919 crop, a fresh supply of infected material being obtained each season. The seeds were heated in quantities of 50 or 100 in an electric oven provided with a constant temperature regulator, and examined individually, after germination, to determine the extent of fungous infection.

Certain preliminary tests indicated that temperatures of 25° and 30° C. are very favourable not only to the germination of cotton seed, but also to the growth in culture of the anthracnose fungus and the development of the disease on cotton seedlings. At 35°

and at 20° cotton germinates well, but the fungus makes no growth at the former temperature and only develops slowly at the latter.

The germinability of air-dry seed was completely destroyed in 15 minutes by dry heat at 90° and 100° C. and seriously impaired after one hour at 80°. A temperature of 70° for 24 hours impaired the germination of seed with a normal moisture content, but not of that with a water content reduced to 8·3 per cent. by laboratory storage. Anthracnose was greatly reduced by this treatment, but not completely eliminated even after 48 hours at 70°.

Cotton seed pre-dried at temperatures of 40° to 50° for 24 hours or more was subjected to a temperature of 70° for 72 hours without marked loss of viability, but this treatment did not control anthracnose. Complete elimination of infection was secured in five out of six tests in which infected seed was pre-dried at 40° to 45° for 24 to 72 hours, or at 50° for 12 to 24 hours, and then heated at 80° for 72 hours, but in no case were comparable results obtained where the heating was stopped after 48 hours. This treatment was accompanied by practically no reduction of germination.

When pre-dried cotton seed was heated at 90°, all anthracnose was killed in 24 hours in seven out of eight tests, in less than 24 hours in seven out of thirteen tests, and in 48 or 72 hours in the three remaining experiments. No appreciable reduction in germination was observed from this treatment when the seed was pre-dried at 50° or above for 24 hours.

Heating at 100° gave complete control of anthracnose in seven out of eight tests, the unsuccessful one being presumably due to the short period of heating (two hours). This treatment, however, greatly reduced the germinability of seed pre-dried at 50° or lower for 24 hours. When pre-dried at 60° for 24 hours the reduction of germination was decidedly less.

Complete control of the disease was obtained at 95° in all of fourteen tests in which the seed was heated for longer than eight hours, and in four out of the six remaining tests in which the heating lasted only eight hours or less. Pre-drying the seed at 50° for 36 hours or at 60° for 18 to 24 hours fitted the seed to endure a temperature of 95° without loss of germinability.

A machine for treating cotton seed in bulk with dry heat is described and figured [see this *Review*, iv, p. 468]. The apparatus is stated to be reliable, partially automatic in operation, and requiring only occasional attention. The viability of the seed-borne elements of the fungus present in infected seed may be destroyed by the use of this machine, in which the effective treatment for the control of the anthracnose without serious reduction of germinability consists of 20 to 24 hours' desiccation at 60° to 65°, followed by twelve hours' heating at 95° to 100° C.

The moisture content of cotton seed was found to be a decisive factor in its ability to withstand temperatures effective in anthracnose control. When the moisture content after drying amounted to 3·9 per cent. of the oven-dry weight, the viability of the seed was seriously impaired by twelve hours' heating at 95°. When the moisture content did not exceed 3·62 per cent. of the dry weight there was no serious loss of viability. When the water content after drying was not greater than 3·19 per cent. of the dry weight,

the seeds heated at 95° for twelve hours germinated more rapidly than untreated seed, presumably owing to changes in the seed coat which facilitated access of water to the embryo.

The viability of the seed-borne elements of *G. gossypii* was prolonged by storing infected seed over such desiccating chemicals as concentrated H_2SO_4 and CaO. This shows that the control of the fungus by dry heat is due, not to desiccation, but to the direct action of the heat on the protoplasm of the organism. The storage of infected seed in hydrogen and carbon dioxide failed to control anthracnose.

BROWN (J. G.) & GIBSON (F.). **A machine for treating Cotton seed with sulphuric acid.**—*Arizona Agric. Exper. Stat. Bull.* 105, pp. 381–391, 4 figs., 3 graphs, 1925.

The authors describe in detail the construction of a simple and relatively inexpensive machine for the bulk treatment of cotton seed with sulphuric acid for the purpose of delinting, stimulating germination, and destroying seed-borne parasites [e. g. *Bacterium malvacearum*]. The type described is capable of dealing with 50 galls. seed every 3 to 15 minutes, according to variety and the grade of the acid. It costs about $400 to construct and, allowing for cost of the acid, labour, and depreciation, the cost per acre is about 18 to 20 cents.

MARSH (R. W.). **An investigation of a sample of diseased seed-cotton sent from Nyasaland.**—*Journ. Textile Inst.*, xvi, 10, pp. T315–T322, 2 pl., 1925.

This paper records the results of a laboratory investigation carried out in the University of Manchester on rotting cotton bolls received from Nyasaland. The bolls showed a considerable yellow staining of the lint, mechanical 'shattering' of the hairs, and also internal injury to the seeds. Cotton stainers (chiefly species of *Dysdercus*), with which such injury is often associated, are very prevalent in Nyasaland, and the rot has been reported to be the most serious disease of cotton in that country.

The discoloration of the lint was due to the presence of a yellow substance in the central canal of the hair cell, this being shown by treatment with the swelling agents cuprammonia and 75 per cent. sulphuric acid. Spores of a species of *Nematospora* were found in numbers lying among the hairs and within the injured seeds, the latter also containing mycelium and sporangia of the fungus. The species of *Nematospora* concerned is apparently identical with Nowell's species C [*West Indian Bull.*, xvi, p. 155, 1916], one of the causes of cotton staining in the West Indies, and the author considers that this fungus was possibly the cause of the injury in the Nyasaland material. The organism was not viable in the specimens examined, but in a footnote it is stated that a similar organism isolated by Dr. W. Brown from Tanganyika material has caused the typical staining of bolls [on cotton grown in a greenhouse].

Other organisms isolated from the bolls were *Rhinotrichum tenellum*, *Melanospora zamiae*, *Chaetomium kuntzeanum*, *Stachyborys lobulata*, species of *Cephalosporium*, *Alternaria*, and *Oedocephalum*, and two species of bacteria. The species of *Cephalosporium*

was of special interest, as it proved to be capable of reproducing the 'shattering' of the hairs seen in the original material.

SKAIFE (S. H.). **The fungous disease of locusts. Report on a preliminary investigation in South-West Africa.**—*Journ. Dept. Agric. S. Africa*, xi, 2, pp. 179–185, 4 figs., 1925.

An epidemic among locusts in South-West Africa in March 1925, resulted in the destruction of whole swarms. In a short time the northern half of the country, which was seriously threatened by the pest, was almost completely cleared of locusts. With the cessation of rain in May the disease disappeared. It was caused by the well-known locust parasite *Empusa grylli*, the morphology and life-history of which are described.

Locusts dying of the disease climb as high as they can on grass stems and the twigs of bushes, and remain head upwards in a vertical position. This usually takes place in the afternoon, death rarely occurring before 3 p.m. A few hours before death, a slight swelling of the abdomen is observed, and the insect becomes sluggish. This is the first active symptom of attack. The hyphal threads in the interior of the locust subsequently pierce the integuments at the joints and between the segments of the abdomen, so that a few hours after death these parts are covered by a fine, white, furry growth, consisting of numerous, parallel conidiophores, at the tips of which the characteristic pear-shaped spores are borne.

On some individuals that do not form this external stage, large numbers of internal spherical resting spores are produced, which enable the fungus to pass through periods of drought. Insects infected just before the dry period set in eventually died, but only produced these resting spores. So far, attempts to germinate the latter artificially have failed, and the actual means of dissemination at the commencement of the rainy season, as well as the period that elapses between infection and death, are still unknown. The fact that the disease was not reported until two to three weeks after the heavy rains had started in January suggests a possible intermediate stage through which the fungus passes, or its transmission through contaminated food.

Attempts to grow the fungus on artificial media have hitherto been unsuccessful.

Locusts at all stages from the second moult are susceptible to attack, and the author has also observed this disease on the short-horned grasshopper.

GILLIATT (F. C.). **Some new and unrecorded notes on the life history of Entomophthora sphaerosperma.**—*Proc. Acadian Entom. Soc. 1924*, 10, pp. 46–54, 1 pl., 1925.

In continuation of Dustan's investigations on the control of the European apple sucker (*Psylla mali*) in Nova Scotia by its fungous parasite, *Entomophthora sphaerosperma* [see this *Review*, iv, p. 218], the writer has obtained certain new data of biological and economic interest.

The conditions necessary for the satisfactory development of the fungus include fairly high temperature, considerable humidity, abundant light, and the presence of large numbers of the insect host. In the economic utilization of the parasite the first-named

factor presents some difficulty in the early spring during the nymphal period, and an attempt was made to overcome this by the use of a modified cold frame, which was placed, in the autumn of 1923, over thickly planted apple seedlings heavily infested with sucker eggs. A quantity of spore-bearing adults were also added at about the same time. In the following spring nymphs emerged in large numbers, and on 17th June some were observed to show the typical development of *E. sphaerosperma*, the conidia of which were actively discharged a few days later. In the cold frame cage the fungus increased rapidly, becoming epidemic by 28th June.

Apple suckers which succumbed during the winter were found on microscopic examination to show 80 per cent. infestation by the fungus (40 per cent. resting spores, 10 per cent. conidia, and 30 per cent. mycelium). The heavy mortality of the insects is attributed partly to the action of the fungus and partly to that of moisture from the frequent sprays applied to the cages.

The reduction in the number of insects during the active progress of the disease in infested orchards was out of all proportion to the apparent distribution of the fungus. The only explanation of this phenomenon appears to be that the instinct of the insects warned them to migrate to neighbouring orchards.

Heavy rains were found to have a retarding effect on the development of the fungus. On the other hand, a large number of diseased insects were always found after foggy periods. The results of counts in an infested orchard showed that 53 per cent. of the affected suckers were males and 47 per cent. females. Most of those which dropped failed to reveal any evidence of fungus infestation until placed in moist chambers in the laboratory, when the mycelium penetrated the integument, developing the characteristic white or bluish mass of hyphae over the insect, and subsequently producing abundant conidia. The distribution of the 90 per cent. infection was as follows: resting spores 2, conidia 14, mycelium 64, and doubtful 10 per cent. Evidently the tendency is to produce the resting-spore stage in much larger numbers under artificial conditions than in the field.

The process of germination was observed in hanging drops. The circular and prominent oil drop first becomes irregular in outline, more dense, and assumes a bronze tinge, which slowly fades, and finally the oil drop disappears entirely, giving the spore wall a much thinner appearance. The contents of the spore appear to grow out into the germ-tube without any shrinkage of the spore. The germ-tubes vary from 5·5 to 7·5 μ in width, and one was observed to attain a length of 210 μ. The number of germ-tubes emerging from a spore varies from one to four. Branching was observed and the abstriction of a small, spherical spore, 6·5 μ in diameter, from a wedge-shaped conidiophore was also seen, but the formation of the conidia could not be definitely traced.

DUSTAN (A. G.). **A study of the methods used in growing entomophthorous fungi in cages prior to their artificial dissemination in the orchards.**—*Fifty-fifth Ann. Rept. Ent. Soc. Ontario, 1924*, pp. 63–67, 1925. [Abs. in *Rev. Appl. Entomol.* Ser. A, xiii, 11, pp. 581–582, 1925.]

A description is given of experiments carried out in Canada with

a view to the rearing, in cages in the open, of the European apple sucker (*Psylla mali*) infested with its fungus parasite *Entomophthora sphaerosperma* [see last abstract]. The green apple bug (*Lygus communis* var. *novascotiensis*) and its fungus parasite, *Empusa erupta* [see this *Review*, iv, p. 93], were also reared in smaller quantities. So far, all efforts at growing the two fungi on artificial media has failed.

The cages, the best type of which were those with wooden sides and movable glass tops to permit adequate temperature control, were built over young seedling apple trees. The chief source of infection utilized was resting spore material collected in the autumn and kept through the winter in ground cages, although a certain number of insects at the stage when they were discharging summer spores were also employed. High temperature, high relative humidity, and crowding of the insects were necessary to ensure adequate infestation and fungous growth. Light as a factor was of no importance, except that the fungus failed to develop if it was entirely excluded. When the maximum shade temperature outside was about 80° F., a maximum of 91° was maintained in the wooden cages and over 80 per cent. average mean humidity, the latter by watering the soil in the cages three or four times a day. Adverse weather conditions usually caused the growth of the fungus to be atypical, or to be stopped entirely.

Larger cages, 6 ft. high by 3 ft. square, were used for obtaining a more extensive supply of diseased material as soon as the fungus had reached the fruiting stage in the smaller cages. When the disease becomes epidemic in the larger cages, it is recommended to collect and distribute in a low, thickly planted orchard, whence the fungus may spread widely in the surrounding country.

DIEUZEIDE (R.). **Les champignons entomophytes du genre Beauveria Vuillemin. Contribution à l'étude de Beauveria effusa Vuill. parasite du Doryphore.** [Entomogenous fungi of the genus *Beauveria* Vuillemin. Contribution to the study of *Beauveria effusa* Vuill. parasite of the Doryphore.]—*Ann. des Épiphyties*, xi, 3, pp. 185–219, 1 pl., 10 figs., 1925.

This memoir commences with a bibliographical survey of preceding investigations on the genus *Beauveria*, followed by a description of the author's study of the possibility of utilizing certain species of this genus in the control of *Leptinotarsa decemlineata* [the Colorado Beetle of the potato], an insect which has caused considerable loss in the Bordeaux region of France. Tests were made of *B. densa*, *B. bassiana*, *B. globulifera*, and *B. effusa*.

The results obtained with *B. densa* were negative, and only by wounding the insect (detachment of the wing, punctures, etc.) was any successful infection obtained. This recognized parasite of the cockchafer, therefore, is not adapted to the control of the Colorado Beetle.

B. bassiana, the cause of the well-known muscardine disease of silkworms, a short account of which is given, is stated to be parasitic on a number of insects, but the author's experiments indicate that the virulence of the attack is insufficient to destroy healthy larvae of the Colorado Beetle under normal conditions.

Two cases of spore infection with *B. globulifera* (comprising in all five beetles) proved fatal, but all further attempts failed, and the author appears to consider this species to give little promise of successful utilization.

In 1922 a mummified beetle affected by *B. effusa* was found in the soil in the Gironde region. Laboratory tests with the hibernating stage of the beetle were undertaken with soil taken from areas in which the insects were numerous. Natural infection, with a mortality of over 60 per cent., occurred in certain of these cases, though it is doubtful that this was entirely due to the fungus. Attempts to infect the insect during its larval stage of activity above ground were not readily successful, and it is concluded that the infection of the hibernating individuals came from the soil. Adults exposed to infection during their period in the soil were readily attacked, the best results in artificial infections being got when an actively sporulating culture was mixed with the soil before the insect descends into the latter, which it does after its third larval moult. Adults during their period of activity above ground were not found susceptible to infection. The first sign of attack is the appearance of the affected insect at the surface of the soil, where it crawls about for two or three days and then dies. Hyphae are visible at the base of the elytra, and at the end of eight days the envelopment by the fungus is complete with the exception of the wings, which stand out untouched. The larvae remain free from attack whilst feeding on the leaves of the potato, but in the presence of abundant spores, and under suitable humidity conditions, the mortality of the adults in the soil was as high as 50 per cent. in 15 days. In dry soil conditions a mortality of 40 per cent. was obtained. Attempts to cause infection through the alimentary canal, by feeding the insects on infected leaves, failed, and the author believes that infection occurs through the body teguments.

In 1924 experiments were carried out with a view to testing the parasitic effect of *B. effusa* on silkworms. A similar softening of the body to that caused by *B. bassiana* occurred after four days, and within seven days an examination of the blood showed the presence of isolated fungal cells in abundance, together with some pluricellular hyphae. On the eighth day short arthrospores and conidia were found throughout the entire body.

PETCH (T.). **Studies in entomogenous fungi. VI. Cephalosporium and associated fungi.**—*Trans. Brit. Mycol. Soc.*, x, 3, pp. 152–182, 1 pl., 1 fig., 1925.

A number of these fungi were studied from dead material and in culture. *Cephalosporium lecanii*, named by Zimmermann in 1898 from *Lecanium viride* on coffee in Java, is very common on this host in Ceylon, and also occurs on several other species of *Lecanium*, on a species of *Ceroplastes*, and on a black *Aleyrodes*. The author has received it from India on *L. viride*, on *L. oleae* on *Phormium tenax* from New South Wales, and on a scale insect on *Citrus* from New Zealand. The fungus is minutely described as it occurs on the host and in culture. The conidiophore may be either simple, and is then either tapering or flask-shaped with a narrow apex, or branched. The conidia (2·5 to 4 by 0·75 to 1·5 μ) are

borne in a loose head, held together by mucilage. Details of the growth on various media are given.

Hyalopus yvonis, described by Dop on *Aspidiotus perniciosus* on coco-nut, is considered to be morphologically indistinguishable from *C. lecanii*; it has not been recognized again since it was described by its author. *Acrostalagmus coccidicola* was described by Guéguen on a coccid on a shrub, possibly of American origin, at Paris; there is no type but, from the description, the fungus cannot be distinguished from *C. lecanii,* though some of the growth characters given by its author differ. From La Plata a *Cephalosporium* sp., with the morphological characters of *C. lecanii* and which also showed the cultural characters given by Guéguen for *A. coccidicola*, was received on *Pulvinaria* sp. on *Citrus.*

The author considers that *Cephalosporium* and *Hyalopus* are identical. Both genera were founded at the same time, *Hyalopus* having page priority, but as *Cephalosporium* has since then been almost universally adopted, it is thought better to retain this name. *Acrostalagmus* differs from *Cephalosporium* in having branched conidiophores and the association of simple with branched conidiophores in the species mentioned above may be indicated by the following usage: *Cephalosporium* (*Acrostalagmus*) *lecanii*, and *C.* (*A.*) *coccidicolum.*

C. (*A.*) *longisporum* Petch is a new species, differing from *C. lecanii* in its larger spores; it occurs principally on a scale on *Acacia decurrens* in Ceylon. *Melanospora parasitica* was found in association with this fungus, and it was determined to be strictly parasitic on the *Cephalosporium,* and not on the insect. Other species described are *C.* (*A.*) *coccorum* n. sp. on *Chionaspis salicis* on ash and on *Lepidosaphes ulmi* on hawthorn in England; a fungus determined as *Spicaria javanica* Bally [see this *Review,* ii, p. 368] on a *Ceroplastes* on *Santalum album* in Ceylon; and *Gonatorrhodiella coccorum* n. sp. on *Lecanium viride* and on a black *Aleyrodes* on coffee in Ceylon.

PETCH (T.). **Studies in entomogenous fungi. VII. Spicaria.**—*Trans. Brit. Mycol. Soc.*, x, 3, pp. 183–189, 1 fig., 1925.

Spicaria prasina (Maubl.) Saw. was described on larvae of *Pionea forficalis* from Japan as *Nomuraea prasina.* The author has received it on *Spodoptera mauritia* and an undetermined larva from Ceylon, and on *Anticarsia gemmatilis* from Florida. The fungus is described morphologically and in its cultural characters. [As stated in the list of *Fungi received at the Imperial Bureau of Mycology*, i, p. 7, 1925, *Botrytis rileyi* is an earlier name for this fungus.]

The author has determined as *S. araneae* Saw. two collections of a fungus on spiders in Ceylon, the colour of which varied from rose to rose-purple. Other entomogenous fungi referred to *Spicaria*, but with which the author is not acquainted, are *S. araneae* Vuill. on *Aphodius fimetarius* in France; *S. aleyrodis* Johnst. on *Aleyrodes variabilis* on *Carica papaya* in Cuba; *S. verticillioides* Fron on cocoons of *Cochylis* [*Clysia*] *ambiguella*, later considered by its author to be a form of *Isaria farinosa*, and called by him *S. farinosa verticillioides* [see this *Review*, iv, p. 671]; and *S. cossus*

Port. & Sart. on larvae of *Cossus*. The characters of these fungi are given briefly from the published descriptions.

PETCH (T.). **Entomogenous fungi: additions and corrections.**—*Trans. Brit. Mycol. Soc.*, x, 3, pp. 190–201, 1925.

A number of exsiccata and fresh specimens have become available since the author's earlier papers on entomogenous fungi, and these have necessitated some alterations in nomenclature. Most of these deal with species of the genera *Hypocrella* and *Aschersonia*, discussed by the author in the *Annals of the Royal Botanic Gardens, Peradeniya*, vii, pp. 167–278, 1921.

The systematic position of *Broomella ichnaspidis* Zimm. is discussed: the author considers it to be certainly a *Podonectria*, and perhaps an abnormal form of *P. coccicola*.

Coccidophthora variabilis Syd. was stated by Hara to be composed of two fungi, a stromatic *Nectria* named by him *N. variabilis*, and which the author states is *N. diploa* B. & C., and a superparasite, *Philonectria variabilis*. The author has found this second fungus again; it is an ascigerous species with four-celled, brown ascospores, and is considered to be a *Melanomma* to which the name *M. variabilis* is given. It has been determined to be the perithecial form of *Sirosperma hypocrellae* [see this *Review*, iii, p. 212].

RE (S.). **Observations on the cultural and biochemical characters of Monilia castellanii (Cryptococcus castellanii) and Monilia macroglossiae (Cryptococcus macroglossiae).**—*Journ. Trop. Med. & Hygiene*, xxviii, 17, pp. 317–319, 1925.

The author's investigations of the cultural and biochemical characters of the *Cryptococcus* isolated from cases of furunculosis and of *C. macroglossiae* [see this *Review*, iv, p. 607] confirm Castellani's description of these two fungi, and support his recent opinion that, as a very small quantity of mycelium develops in certain liquid media, both organisms should be referred to the genus *Monilia*, *sensu lato*, rather than to *Cryptococcus*. The name *M. castellanii* is suggested for the furunculosis fungus.

THOMSON (J. G.) & ROBERTSON (A.). **Notes on the cultivation of certain amoebae and flagellates of man, using the technique of Boeck and Drbohlav.**—*Journ. Trop. Med. & Hygiene*, xxviii 19, pp. 345–349, 2 figs., 1925.

In the course of this communication on the cultivation of certain amoebae and flagellates of man, mention is made of the presence of *Blastocystis hominis* [see this *Review*, iv, p. 543] in cultures of several of these organisms. In some cases the growth of the fungus was so rapid and abundant as entirely to occlude the protozoa. *B. hominis* was, however, completely absent from cultures of *Entamoeba histolytica*.

Division of Veterinary Education and Research. Disease in cattle and sheep due to mouldy Mealies.—*Journ. Dept. Agric. S. Africa*, xi, 4, pp. 291–292, 1925.

The practice, common in South Africa, of turning cattle and

sheep into old mealie [*Zea mays*] lands as soon as veld grazing becomes scarce leads, after a very wet season such as 1925, to serious disease in the animals due, it is said, to the poisonous effects of the mouldy cobs, which are attacked by various parasites, *Diplodia zeae* being the chief.

The disease, which produces complete paralysis of the animal, has been known for many years to exist amongst cattle, but feeding experiments carried out in 1925 at Onderstepoort showed that sheep were also affected. Mealies infected with *D. zeae* were fed to sheep, and symptoms practically identical with those of the disease in cattle were produced. The numerous losses in 1925 amongst sheep grazed in mealie lands are attributed to this fungus.

It is recommended that, when the cobs are known to be infected, cattle and sheep should not be grazed on the old mealie lands, which should be burnt over and allowed to lie fallow for one or more seasons. Furthermore all cobs, both defective and sound, should be collected at harvesting.

Appendix II. Deterioration of fabrics by micro-organisms.— *Dept. Sci. and Indus. Res., First Rept. Fabrics Co-ordinating Research Committee*, pp. 14–28, 1 pl., 1925.

Systematic work on the isolation and identification of mould fungi which cause the deterioration of cotton materials [see this *Review*, iii, pp. 37, 517; iv, p. 280] has been in progress for some time by the British Cotton Industry Research Association, and the Fabrics Co-ordinating Research Committee has arranged for samples of fabrics of various kinds to be sent to eleven stations in widely separated parts of the world (Australia, Ceylon, Cyprus, England Kenya, South Africa, Straits Settlements, and Trinidad) for exposure to different climatic conditions and varying degrees of intensity of heat, light, and moisture, in order to serve as 'traps' for micro-organisms. Seven types of fabric are to be used, namely, American, Egyptian, and Indian cotton, dew-retted and water-retted flax, wool, and hemp.

There are four methods of treatment which seem likely to protect the fabrics in question against the attacks of micro-organisms: (1) the addition of antiseptics to the cloth either alone or incorporated with the size; (2) the addition of antiseptic substances capable of combining with or being absorbed by the constituents of the fibre; (3) the treatment of the fibre by physical processes to increase its resistance; and (4) the envelopment of the fibres by a layer of material impermeable to and non-assimilable by micro-organisms.

Disinfection is not essential; inhibition of growth is all that is necessary. The choice of chemicals for antiseptic purposes is limited, since the substance selected must be relatively insoluble and non-volatile in order to withstand weathering, yet slightly soluble or volatile to exert an antiseptic action.

In 1922 a sample of deteriorated fishing net was examined at the Holton Heath Bacteriological Laboratory. A large proportion of the fibres near and within the knots exhibited symptoms of bacterial attack, while between the knots comparatively little damage was detected. The bacteria were of the usual types occurring in sea water, and comprised spore-bearing forms of the *mesentericus* group

and other denitrifying bacteria. After ten days' incubation at 30° C. under anaerobic conditions, the material from the knots showed the characteristic cellulose-destroying organisms. It was concluded that the deterioration of the net was due to the destructive action of micro-organisms, the proportionally greater damage in and near the knots being ascribed to the longer retention of moisture in them.

Samples of Pita and Cumari fibre (which are extensively used for making fishing nets) were subjected to microbiological decomposition, together with a control sample of Indo-American cotton; one sample of each was buried in soil, and another placed in a flask containing food substances and inoculated with a culture of cellulose-destroying bacteria. Deterioration of the cotton sample commenced after 12 days, and after 47 days the fibres were badly damaged. Practically no deterioration occurred in the Cumari fibres and very little in the Pita during a corresponding period. It was concluded that the resistance of these fibres was due to their well-developed protective sheath, the removal of which led to the infection of the material by the usual organisms.

KLETSCHETOW (A. N.). **Untersuchungen über die biologischen Ursachen der Leinmüdigkeit des Bodens.** [Investigations of the biological causes of flax-sickness of the soil.]—*Journ. f. Landw. Wissensch.* (Moscow), i, 7–8, pp. 511–521, 1924. [Abs. in *Zeitschr. für Pflanzenkr.*, xxxv, 5–6, pp. 208–209, 1925.]

The author investigated the causes of 'flax-sickness' of the soil at the Agricultural Academy of Moscow (Petrovsko-Razoumovskoye) where flax was cultivated on some plots for nine consecutive years, at the end of which the crop completely refused to grow. As the soil was copiously manured with mineral and organic fertilizers, and other plants, e. g., *Capsella bursa-pastoris* and *Thlaspi arvense*, developed vigorously on it, there could be no question of exhaustion of the soil, nor of the accumulation in the soil of toxic substances secreted by the flax. On the other hand, the presence of the following parasitic fungi was determined: *Asterocystis radicis*, *Thielavia basicola*, *Colletotrichum lini*, *Fusarium lini*, *Macrosporium* sp., *Alternaria* sp., *Cladosporium herbarum*, a species closely related to *Phoma exigua* Desmaz. (on the roots of the flax), and *Pythium de Baryanum*. The author comes to the conclusion that the trouble is due not to any one of these fungi alone, but to the combined action of the whole series [see also this *Review*, iv, p. 220].

WORMALD (H.). **A leaf blotch of the Shasta Daisy.**—*Gardeners' Chron.*, lxxviii, 2027, pp. 353–354, 1 fig., 1925.

In August [1925], near Maidstone, Kent, several plants of the Shasta daisy (*Chrysanthemum maximum*) were found with large, more or less circular, coalescing, concentrically zoned blotches of dead tissue, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, on the leaves, some of which were withering. Dark dots on the upper surface of the blotches proved to be pycnidia of the fungus *Septoria leucanthemi*, a parasite which has not previously been recorded for England, so far as is known.

Nisikado (Y.) & Miyake (C.). **Ueber ein neues Helminthosporium auf Panicum crus-galli L.** [On a new *Helminthosporium* parasitic on *Panicum crus-galli* L.]—*Ber. Ōhara Inst. Landw. Forsch.*, ii, 5, pp. 597–612, 1 pl., 1925.

In the present paper a description is given of the morphology and physiology of a species of *Helminthosporium* which the authors first observed in October 1919, attacking the leaves and leaf sheaths of plants at all stages of development of *Panicum* (*Echinochloa*) *crus-galli* var. *submuticum* Mey. and *P. crus-galli* var. *hispidulum* Hack., and which they state was fully described and named *H. crus-galli* n. sp. in a paper sent by them in January 1923, for publication in Tokio, where it was destroyed during the disastrous earthquake and consequent conflagration in September of the same year.

The first symptom of the disease appears early in the spring in the form of isolated, irregularly dispersed, spindle-shaped, yellow spots, from 0·5 to 3 mm. long by 0·25 to 1·5 mm. broad. From one to three days after their appearance, a dark point is produced in their centre and rapidly spreads in the form of a dark brown patch over the whole area of the spot, while the latter also increases in size, and, in some cases, coalesces with others, finally covering the whole surface of the leaves, which then turn grey and dry up. On mature leaves the preliminary yellow discoloration is frequently absent, the leaves turning at once either grey or brown and drying up very rapidly. The same symptoms also appear on the leaf sheaths.

The leaf tissues underlying the spots are pervaded by a brownish or olive-green, septate mycelium, usually more or less constricted at the septa, running between the parenchyma cells. The brown or olive-green conidiophores arise from a submerged mycelial stroma and emerge on both sides of the leaves through the stomata in groups of 1 to 6 (usually 1 to 3); they are erect, somewhat rigid, for the most part supplied with geniculate bends towards the apex, unbranched, with 1 to 8 (usually 4 to 7) septa, not constricted, of a lighter colour at the top, and 129 to 473 by 7 to 11 μ in diameter.

The conidia [the size and septation of which were studied biometrically and are given in tabular form] measure from 45·9 to 163·2 by 15·3 to 26·8 μ, and have from 1 to 10 septa; the average from the host was $124{\cdot}03 \pm 0{\cdot}85$ by $20{\cdot}90 \pm 0{\cdot}08\ \mu$, with $6{\cdot}44 \pm 0{\cdot}08$ septa. They are acrogenous or on the knee-bends, definitely spindle-shaped and tapering at both ends, olive-brown, usually unconstricted, with a thick epispore, and have a wart-like hilum at the base. They germinate with a germ-tube from each end.

The morphological features of this fungus agree in most respects with those of *Helminthosporium monoceras* described by Drechsler (*Journ. Agric. Res.*, xxiv, 8, pp. 641–739, 1923) as parasitic on the same host, and the authors adopt this name.

Spittall (J. P.). **Varietal susceptibility of the Apple to various injuries.**—*Proc. Acadian Entom. Soc. 1924*, 10, pp. 17–22, 1925.

The writer has collected data for some years past on the varietal susceptibility of apples to various injuries, including scab [*Venturia*

inaequalis], in the Maritime Provinces of Canada. The average incidence of this disease for two years in an untreated orchard was 45·2 per cent. on Stark compared with only 16·5 per cent. on Baldwin. In another case in which the figures from all the treated plots are included in the average, the incidence of infection on Stark was 61·3 and on Wagener 57·4 per cent. The corresponding averages on treated trees only were 15·5 per cent. for Stark and 6·0 per cent. for Wagener. In a table showing the average incidence of scab for three years on five varieties, the figures were as follows: Gravenstein 54·5, Baldwin 12·6, Northern Spy 21·1, Golden Russet 16·2, and King 8·5 per cent. Baldwin, Spy, and King varieties were found to be highly susceptible to injury from lime-sulphur lead arsenate, showing an average of 35, 38, and 21 per cent. burning, respectively, in two years. It is pointed out that lack of sunshine and wet weather accentuate the susceptibility of apple foliage to this type of injury.

WALKER (G. P.). **Spray vs. dust on Apples in New Brunswick.**—*Proc. Acadian Entom. Soc. 1924*, 10, pp. 8–16, 1925.

Since 1921 the writer has carried on a series of experiments at Fredericton, New Brunswick, to determine the relative merits of the spray and dust treatment for the control of orchard pests on Fameuse and McIntosh apples.

The schedules used were as follows. Spraying: (1) When blossom buds were showing pink: 3–10–40 Bordeaux mixture plus $1\frac{1}{2}$ lb. arsenate of lime. (2) After fall of blossoms: 1 lb. soluble sulphur plus $1\frac{1}{2}$ lb. arsenate of lime per 40 galls. water (in 1924, 12 lb. wettable sulphur plus 2 lb. arsenate of lead per 40 galls. water). (3) A fortnight after (2): same as (1). Dusting (times as for spraying): (1) 12–8–80 copper arsenic dust, 50 lb. per acre; (2) 90–10 sulphur lead arsenate dust, 75 lb. per acre; (3) same as (1).

The results of the experiments [which are presented in tabular form] almost uniformly show a larger percentage of unblemished fruit in the dusted than in the sprayed plot, this being entirely due to the large amount of russeting in the latter, especially during seasons when dull weather and moisture were prevalent. In 1921 the incidence of russeting in the McIntosh block was nearly 68 per cent. higher in the sprayed than in the dusted plot, while the Fameuse block showed only 2 per cent. difference. Only in 1921 did dusting give better control of scab [*Venturia inaequalis*] than spraying, but in that year the incidence of infection was extremely slight (1·31 per cent.) in the check plot. In general, it may safely be assumed that spraying gives somewhat better control of scab than dusting. This superiority is believed to be largely due to the greater wastage of the dust, which appeared to be continuously blown about by the wind. The average incidence of scab on both varieties for the four years was 5·28 per cent. on the sprayed plot, 10·07 per cent. on the dusted, and 37·44 on the check, while that of russeting was 24·1, 9·33, and 0 per cent., respectively.

The total cost per acre (72 trees) of the dusting operations for the three seasons was estimated at \$10.01 and that of spraying at \$15.69.

BIRMINGHAM (W. A.) & MILLS (H. A.). **Experiments for the control of black spot of Apple due to the fungus Venturia inaequalis (Cke) Aderh.**—*Agric. Gaz. New South Wales*, xxxvi, 9, pp. 665–666, 1925.

These experiments on the control of black spot [scab] of the apple (*Venturia inaequalis*) were carried out in 3 series, in each of which 5 trees were sprayed and 5 left as controls. The 1st series was sprayed with lime-sulphur between the early spur burst and pink stages, followed by lime-sulphur at the calyx stage; the 2nd series with Bordeaux mixture followed by lime-sulphur; and the 3rd series with Bordeaux mixture followed by Bordeaux mixture. The lime-sulphur used was summer strength and the Bordeaux mixture 6–4–50. The third series gave the best control, 88·2 per cent. clean fruit with, however, slight to pronounced russeting; series 2 came next with 61·9 per cent. clean and slight russeting in some cases; series 1 gave 17·2 per cent. and no russeting; whilst in the control 91·6 per cent. of the fruit was affected with scab to a greater or less degree.

ZELLER (S. M.) & CHILDS (L.). **Perennial canker of Apple trees (A preliminary report).**—*Oregon Agric. Exper. Stat. Bull.* 217, 17 pp., 22 figs., 1925.

It was reported to the American Phytopathological Society, Pacific Division, in June 1925, that there exist two distinct forms of the diseased condition of apple trees in the United States and British Columbia commonly known as the north-west apple tree anthracnose and attributed to *Neofabraea malicorticis* [see this *Review*, i, pp. 378, 386]. In the present paper the authors describe, under the name of perennial canker, the second form which, in some of its stages, is very difficult to distinguish from that caused by *N. malicorticis*. While the latter infects during the autumn and the winter, and is a virulent parasite capable of producing a canker wherever a spore alights, even on sound bark, the second form is caused by a weak parasite infecting, apparently in the spring, through wounds or injuries of traumatic, weather, or insect origin. Furthermore, while *N. malicorticis* does not spread beyond the limits of the first year's growth (although the fungus continues to live in the dead tissues through the second year, when the spores of the perfect stage are produced and discharged, thus causing new infections near the margins of the old cankers), the perennial canker develops year after year by the spread of the mycelium in the healthy tissues surrounding the canker formed during the previous season. Other differences consist in the different shape of the conidia of the two organisms, and in their different behaviour on certain culture media.

Perennial cankers are found on branches of various ages and sizes, but seldom on the trunk below the insertion of the main limbs, except when the trunks suffer from winter injury, in which case the disease spreads rapidly and may kill the whole tree. The colour of the cankers depends to a large extent on the age of the bark attacked and on the climatic conditions in different localities. On very young water shoots or on one-year-old wood, they have a glassy surface and are of a light brown colour, alternating, in

some cases, with purplish-brown concentric rings. On old bark the cankers are reddish-brown or purplish, with a tendency to form concentric rings of a lighter colour at the time when the acervuli begin to be produced. In the spring, when healthy wood surrounding a canker begins to grow, a fissure is produced rather definitely limiting the edge of the canker, thus giving the latter a sunken appearance which is augmented by the drying-up of the affected portions of the bark. In this stage, it is very difficult to differentiate from anthracnose. As the canker matures, the dried-up bark usually adheres very firmly to the underlying wood and becomes smooth and glassy, although in some cases it may be cracked and break away from the wood. Generally the cankers tend to elongate rather than to grow laterally, thus giving them an elliptical shape, with concentric annual calluses as commonly described for the open type of European canker [*Nectria galligena*]. The wood underlying the cankers is discoloured to a considerable depth.

Besides the bark, the fungus may also attack the fruit, producing a brown, soft rot, without the zonation which usually characterizes the fruit rot caused by *N. malicorticis*, and of much less rapid spread than bitter rot [*Glomerella cingulata*]. This fruit rot, however, has not proved so far to be of any economic importance in Oregon. Pear trees are less often attacked, and then only on the bark.

Morphologically the causal fungus is typical of the species grouped under the form-genera *Gloeosporium* and *Myxosporium*, but the authors are inclined to include it in the first genus, as the second is ordinarily confined to the bark. As it appears not to have been previously described, the name *G. perennans* sp. nov. is given to it and an English diagnosis is appended. The acervuli are subepidermal or deeper, and the conidia, which are borne on branched conidiophores, are hyaline, irregular in shape and size, but mostly ellipsoid (in contrast to the characteristically curved spores of *Neofabraea malicorticis*), usually larger at one end, and 12 to 20 by 4 to 6 μ in diameter. On germination, hyaline, ovoid to ellipsoid, sometimes curved, secondary spores, 3 to 10 by 1 to 2 μ in diameter, are produced.

The known geographical distribution of the fungus ranges from the Okanagan Valley, British Columbia, to the Willamette Valley, Oregon. It has also been reported from the Spokane and Wenatchee valleys in Washington, from certain stations along both sides of the Columbia River, and especially from the Hood River valley.

No preventive measures against this disease are yet definitely known, but the liberal use of Bordeaux mixture, particularly the spring application of Bordeaux-oil mixtures (as there are indications of a definite relationship between the woolly aphis and infection), appears to be of some assistance in checking its progress. In infected areas pruning should be reduced to a minimum, and cuts on the main limbs of the trees should be avoided as much as possible. Eradication measures involve cutting out all the diseased tissues, and the painting over of all wounds with an antiseptic dressing, preferably Bordeaux paste stirred into small amounts of raw linseed oil until a rather thick, smooth paint is formed.

CUNNINGHAM (G. H.). **Incidence of Apple canker (Nectria galligena Bres.) in New Zealand.**—*New Zealand Journ. of Agric.*, xxxi, 2, pp. 102–103, 1925.

Since the publication of the author's recent book on the fungous diseases of fruit trees in New Zealand [see this *Review*, iv, p. 673], in which the occurrence of apple canker (*Nectria galligena*) in the Dominion is denied, specimens of branches affected by this disease have been collected at Whangarei. An examination revealed the presence of both the conidia and perithecia of *N. galligena*. A brief description is given of the symptoms, and recommendations for treatment are made.

HOPKINS (C. J.). **Apple fruit-spot. Phoma pomi (Passer.).**—*Journ. Dept. Agric. S. Africa*, xi, 4, pp. 366–370, 4 figs., 1925.

In April, 1925, apples from a locality in the Transvaal proved on examination to be infected with *Phoma pomi* Passer., the cause of the *Phoma* fruit spot of North America [see this *Review*, iii, pp. 43, 587]. This is the first record of the disease in South Africa, but, from observations on market specimens, it is believed to occur in other parts of the country.

The spots start from the lenticels, and in the early stages are not usually sunken. Later, as the spots enlarge, they become dark red, brown, or even black in colour and slightly depressed. Pycnidia occur in the centre of the spots in advanced stages. The pycnidia, conidia ('cylindrospores'), and chlamydospores of the fungus are briefly described and figured.

Experiments with infected apples kept in an ice chest showed that the development of the disease is arrested indefinitely in cold storage.

For the control of the disease midsummer spraying with Bordeaux mixture (3–3–50), or preferably lime-sulphur, is recommended, except where the trees have already been sprayed for scab [*Venturia inaequalis*], when further treatment is unnecessary.

TALBERT (T. J.). **Cedar rust of Apples in Missouri.**—*Missouri Agric. Exper. Stat. Circ.* 135, 8 pp., 6 figs., 1925.

This is a brief, popular account of the rust (*Gymnosporangium juniperi-virginianae*) of apples, with a succinct description of the symptoms of the disease both on apples and on the red cedar [*Juniperus virginiana*]. Special stress is laid on the economic importance of the rust in the United States, and the eradication of all cedar trees to a distance of $1\frac{1}{2}$ to 2 miles from apple orchards is strongly advocated. Mention is also made that the rust is included in the category of dangerous diseases prohibited by law in several States.

Armillaria.—*Fruit World of Australasia*, xxvi, 10, p. 402, 1925.

The following practical instructions are given for the eradication of *Armillaria mellea* from South Australian apple orchards, in which it is stated to occur only in patches where drainage is deficient. The spread of the rhizomorphs may be prevented by digging a trench round the suspected area to a depth of approxi-

mately 18 inches, followed by underdraining, and spreading a heavy dressing of iron sulphate over the roughly broken soil. All infected roots or portions of the trunk should be cut out and burnt, and the parts treated with Bordeaux paste consisting of 1 lb. copper sulphate, 1 lb. freshly slaked lime, and about 1 gall. water.

BROOKS (F. T.). **Polyporus adustus (Willd.) Fr. as a wound parasite of Apple trees.**—*Trans. Brit. Mycol. Soc.*, x, 3, pp. 225–226, 1925.

In recent years considerable damage has been caused to apple trees in the Wisbech area [England] by a fungus which infected the trees through wounds made in the process of thinning out. The progress of the fungus is indicated by the death and cracking of the bark and the disorganization of the wood. Sometimes its growth is arrested and a marked fissure then develops between the healthy and dead bark, valuable branches being lost as the result of such attacks. No variety appears to be immune, but Newton Wonder and Lord Derby are said to be the most seriously affected. Dressing wounds with Stockholm tar or gas tar has proved utterly ineffective against the disease.

The identification of the fungus was difficult, as fructifications have never been seen in the fruit plantations. Pure cultures of the mycelium gave only rudimentary polyporoid fructifications, but recently typical fruit bodies of *Polyporus adustus* have invariably been produced on large diseased branches kept under suitable laboratory conditions. The author considers that there is no doubt that this fungus is the cause of the injury.

Experiments on keeping Apples in oiled paper wrappers.—*Journ. Min. Agric.*, xxxii, 7, pp. 626–629, 1925.

This paper gives the results of a series of experiments carried out, in the winter of 1924–5, at a number of centres in the principal fruit-growing areas of England, to ascertain the effect of oiled wraps on different varieties of apple in ordinary cool storage. Apples wrapped in oiled paper, in ordinary paper, or left unwrapped were packed in standard boxes in storage sheds, and examined at intervals.

The detailed results for a number of centres are given, and, generally speaking, the oil-wrappered apples showed less rotting and withering than those unwrapped or wrapped in ordinary paper. At one centre, Bramley's Seedling (season November to March) stored on 8th October [1924] gave the following result on 27th February [1925]: oiled wraps, 114 perfect; white paper wraps, 86 perfect; unwrapped, 47 perfect (in each case out of 120 stored). At another centre, Hanwell Souring (season February to April) stored on 21st October gave on the 23rd March the following: oiled wraps, 91 perfect out of 138; ordinary paper wraps, 101 out of 126; and unwrapped, 71 out of 136.

REIMER (F. C.). **Blight resistance in Pears and characteristics of Pear species and stocks.**—*Oregon Agric. Exper. Stat. Bull.* 214, 99 pp., 35 figs., 1925.

A detailed account is given of experiments in Oregon to test the

relative resistance to blight (*Bacillus amylovorus*) of practically all the known wild species of pears and most of the available cultivated varieties from Europe, Africa, and Asia. The characteristics of the five species that are considered to be the most important from the point of view of blight resistance, namely *Pyrus communis*, *P. calleryana*, *P. ussuriensis*, *P. betulaefolia*, and *P. serotina* (all but the first, eastern Asiatic species) are discussed in detail.

The tests indicate that in every species most of the seedlings show a higher degree of resistance in the older wood than in the young shoots. The common European species, *P. communis*, which includes most of the best cultivated varieties, is the most susceptible of all. Not a single immune seedling or variety of this species has been found, although a few cases of marked resistance have been observed. When inoculated into the roots, 43·8 per cent. of the seedlings became blighted. The French pear seedling is, however, remarkably resistant to mushroom root rot (*Armillaria mellea*), and is considered as an ideal stock where the form of blight which affects the roots is not prevalent. Amongst the American varieties of *P. communis*, Farmingdale, Longworth, and Old Home have proved exceptionally blight resistant, but are of poor quality. Kieffer, a hybrid between Bartlett and the sand pear (*P. serotina*), is probably the most valuable hybrid grown commercially in America, but is much inferior in quality to such varieties as Bartlett, Bosc, or Anjou.

Of the species suitable for root stocks, *P. calleryana* shows the highest degree of resistance and is the most useful where root blight is prevalent and the winter is mild. When inoculated in the roots only 9·1 per cent. of the trees were affected, and 5·5 per cent. proved immune in all parts of the tree.

Both the wild type and a large proportion of the cultivated varieties of *P. ussuriensis* show a marked degree of resistance, although certain cultivated varieties are, on the contrary, highly susceptible. Seedlings of six cultivated varieties of Chinese origin (Ba Li Hsiang, Chien Pa, Huang Hsiang Siu, Hung Quar, Ma Ti Huang, and Ta Tou Houang) have proved immune, but the definite value of these strains as stocks has yet to be demonstrated. An effective preventive of losses from trunk and root blight in the newer orchards, should be, however, to plant a resistant variety on a resistant root stock such as *P. calleryana*, or Ba Li Hsiang (where too cold for *P. calleryana*), and topwork them when three or four years old with the desired commercial variety.

The Chinese species *P. betulaefolia* and the Japanese species *P. serotina* showed 23·5 per cent. blighted, of the trees inoculated in the roots; while 3·5 per cent. and 2·6 per cent., respectively, proved immune from attack in all parts of the tree. The first species is adapted to soil which contains too high a proportion of alkali for the *P. communis* and *P. ussuriensis* stock, while the second is recommended only on deep, well-drained soils, free from *A. mellea*, and provided the climate is not cold.

A table is given showing the reaction of 32 different species of *Pyrus* to inoculation with *B. amylovorus*, and it is mentioned that individual seedlings of the four Eastern species mentioned above have proved immune, so that if this character persists on asexual

propagation there should be ample material for producing resistant root stocks. Other tables show varietal susceptibility within the species *P. ussuriensis* and *P. communis.*

These inoculation results should, however, only be taken as representative of regions with climatic conditions similar to those of southern Oregon.

HARTMAN (H.). **Core breakdown in Pears may be avoided.**—*Better Fruit*, xx, 3, pp. 9, 15–16, 1 fig., 1925.

Most of the information in this paper has already been presented from another source [see this *Review*, iv, p. 746]. Of interest is the brief description of the disease, which is characterized in its incipient stages by a soft, watery condition of the affected tissue, later accompanied by a brownish or black discoloration, and eventually by a putrid odour. These symptoms may be confined to the seed cavity or extend to the entire core and surrounding flesh.

The term 'core rot' is regarded as inappropriate, owing to the absence of a specific organism in the diseased tissues, while 'internal browning', brown heart, and 'internal breakdown' have been applied to physiological disturbances of the apple, and hence cannot aptly be used in this connexion.

EZEKIEL (W. N.). **Presence of the European brown-rot fungus in America.**—*Phytopath.*, xv, 9, pp. 535–542, 3 figs., 1925.

In continuation of his work on *Sclerotinia americana* [*S. cinerea* forma *americana* Wormald: see this *Review*, iv, p. 508], the author describes methods for the differentiation of this species from *S. cinerea.*

On potato dextrose agar, *S. cinerea* produces conidia only sparsely and never in pustules, whilst *S. americana* produces abundant conidia in definite pustules, except in the case of the uncommon varieties V and VI. In Petri dish cultures on the same medium *S. cinerea* grows slowly and shows zonation and lobing, whilst *S. americana* rapidly produces a homogeneous growth except for numerous concentric circles of conidia or aerial hyphae. In hanging drop cultures, *S. cinerea* germinates by a germ-tube which soon branches, while *S. americana* has a straight germ-tube with no side branches or only small ones; this characteristic branching also persists in the mycelium. The average lengths of the cells of the older hyphae is 36 μ in *S. cinerea* and 66 μ in *S. americana.*

The fungus named by Barss *S. oregonensis* [see *Oregon. Agric. Exper. Stat. Circ.* 53, 1923, and this *Review*, iv, p. 487] has been found to agree morphologically, culturally, and in its life-history with *S. cinerea*, of which it is considered to be a synonym.

ENCKE (F. v.). **Der Polsterschimmel oder Grindfäule des Obstes.** [The cushion fungus or brown rot of fruit.]—*Deutsche Obst- u. Gemüsebauzeit.*, lxxi, 38, pp. 551–552, 1925.

The symptoms and life-history of the brown rot fungi are described, with brief directions for their control by cultural measures. Three species are discussed: *Sclerotinia fructigena*, characterized by cream-coloured to yellowish-brown pustules, occurring on core fruit (apples and pears); *S. cinerea*, with ashen-

coloured pustules, found on stone fruit (especially sour cherries); and *S. laxa* on apricots. Mention is further made of *S. cydoniae* on quinces and of *S. mespili* on *Mespilus* [see this *Review*, iii, p. 370].

PARKER (C. S.). **Coryneum blight of stone fruits.**—*The Howard Review* (Howard University, Washington, D.C.), ii, 1, pp. 3–40, 5 pl., 1925.

This is the full paper, of which a preliminary notice was published in 1923 [see this *Review*, iii, p. 280]. The work was carried out in Washington in 1922–3, and was directed primarily to determine by cross-inoculations whether the forms of *Coryneum* on peaches, apricots, and cherries were all belonging to the same species, as well as to study the relations of the parasite to the host, and the morphology of the former. The fungus was identified as *C. beijerinckii* on all three hosts, the fruit body being regarded as an acervulus which bears spores on the twigs but is generally sterile on the leaves and is rare on the fruit. In culture only spores borne on mycelial hyphae were produced. Neither pycnidia nor perithecia were observed. On peach twigs from Walla Walla a distinct form with dark, constricted, and slightly larger spores occurred.

By means of artificial inoculations from pure cultures the typical symptoms of blossom blight, leaf and twig blight, shot hole, fruit spotting, canker formation on the twigs, and twig gummosis were produced in the greenhouse or laboratory, and the fungus was reisolated from the diseased tissues. These symptoms were not found to differ materially on the peach and apricot, but cherry leaves sometimes show elongated oval spots, parallel to a vein, and the spots on cherry fruits are larger and cause more shrivelling and dry rot than on the other hosts. Plum infections observed in the field resembled those of the peach and apricot. Dropping of the young leaves and fruit may result from severe attacks. The twig infections are thought to precede those on the leaves and fruit, and to be the source of the latter in many cases. On cut twigs the fungus was found to remain alive for at least six months. The disease is less severe in the warmer valleys in which stone fruits are most cultivated than elsewhere in the State. Excessive moisture is thought to predispose to infection, which was found to occur only through stomata or wounds. There were some indications of varietal differences in susceptibility, Early Golden apricots being much more severely attacked than the Hemskirke variety in one orchard, and Elberta peaches than Carman in another.

Except the strain from Walla Walla mentioned above, no differences were observed in cultures from the different hosts, and the fungus from peach was able to infect apricot and cherry.

OCFEMIA (G. O.) & AGATI (J. A.). **The cause of the anthracnose of Avocado, Mango, and Upo in the Philippine Islands.**—*Philipp. Agric.*, xiv, 4, pp. 199–216, 3 pl., 1925.

Anthracnose of avocado pear (*Persea gratissima*) [see this *Review*, iii, p. 380], mango (*Mangifera indica*) [see this *Review*, iv, p. 182], and upo (*Cucurbita pepo*), due to *Glomerella cingulata*, is stated to be a serious disease in the Philippine Islands. On the avocado it may infect 10 to 20 per cent. of the leaves, occasionally involving

also the primary branches or even the entire tree, while it may destroy up to 50 per cent. of the immature avocado and mango fruit. The disease is further responsible for a certain number of failures in the grafting and budding of both these trees. Ten per cent. of picked mango fruit may suffer from the storage rot due to the fungus.

On the avocado and mango the disease may appear in the form of small or large, circular to irregular, brownish to purplish spots on leaves, twigs, and fruits, accompanied by a reddish-brown discoloration of the flowers. The leaves, stems, and fruit of upo may be infected.

The acervuli formed in pure culture may be with or without setae and, in general, the conidial stage agrees with the descriptions of other workers. Under field conditions the fungus produces the perfect stage on the dead infected portions of the host, and it may be induced to form perithecia on artificial media by a method which is briefly described. The perithecia on all three hosts agree fairly closely and are within the limits of variation reported for *G. cingulata*. Their morphology is described in detail.

In the Philippines the avocado, mango, and upo strains have been shown by inoculation and cross-inoculation experiments to be capable of infecting chilli pepper [*Capsicum annuum*] and tomato in addition to the three primary hosts, while the two first-named infected citrus, banana, and various other plants of economic importance. *G. musarum* [see this *Review*, ii, p. 279], isolated from banana, is also able to infect the above-mentioned hosts. *Colletotrichum gloeosporioides*, isolated from citrus affected with wither tip [see this *Review*, iv, p. 666], can infect avocado and mango. From these and other data [which are summarized] *G. cingulata* would appear to have a wide host range as well as an extensive geographical distribution.

Cool, moist, shady conditions are favourable to the development of the fungus on young, tender, and succulent growth.

Control measures should include careful sanitation, the use of resistant varieties (such as Bottleneck avocados and Cambodiana mangoes), and possibly the application of protective sprays.

Fruit diseases and pests. Bunchy top in Bananas.—*Fruit World of Australasia*, xxvi, 10, p. 432, 1925.

The results obtained to date at the Tweed Heads laboratory, New South Wales, which has been established for the investigation of the bunchy top disease of bananas [see this *Review*, iii, p. 527], indicate that the disease is probably of the nature of a virus transmitted by insects.

HANSFORD (C. G.). **Some remarks on questions raised by the Panama disease of Bananas.**—*Proc. Ninth West Indian Agric. Conf., 1924*, pp. 41–51, 1925.

An account is given of the gradual spread and present position of the Panama disease of bananas, caused by *Fusarium cubense*, in Jamaica [see this *Review*, iv, pp. 23, 620], where it was first discovered in 1912 in two distinct centres.

In discussing the ecology of the disease, it is stated to be most severe in regions of heavy and frequent rainfall and where the land is liable to floods. But where bananas are grown in dry regions under irrigation they normally escape the disease, though inoculation experiments have proved that plants grown under such conditions are not immune from artificial infection.

A large series of isolations and cultures of species of *Fusarium* from various sources in Jamaica has been studied by the author, who concludes that there are many saprophytic strains morphologically indistinguishable from *F. cubense.* The only sure means of recognizing the latter is the production of banana wilt with it. Infectious strains were only obtained from diseased bananas or from the soil in their immediate neighbourhood. It is concluded that the conception of species within the *Elegans* section of *Fusarium* [see this *Review*, iv, p. 706] is in need of revision. The author is, in fact, inclined to regard all the *Elegans* section as comprising but a single morphological species, divided into a number of distinct strains.

The gradual spread of the disease in Jamaica is attributed to the planting of suckers in incipient stages of the disease. Other methods of spread are by banana trash and the indiscriminate use of this trash for mulching purposes; wind-borne spores; and transportation of diseased soil to hitherto unaffected areas.

The methods of treatment adopted by the Jamaican Department of Agriculture for the control of this disease are described in detail [see this *Review*, v, p. 63]. The treatment of cases of disease as soon as discovered, the quarantining of infected land, the inspection of all suckers before planting, and the careful disinfection of tools, have resulted in checking the spread to a marked degree. Attention is at present concentrated on the efficient protection of healthy areas of the commercial Gros Michel variety and also on the possible production of a variety both resistant to disease and suitable for the market [see also next abstract], which could be grown on diseased lands. The number of inspectors charged with the carrying out of protective measures in the island has been increased from four to ten within the last few years.

ASHBY (S. F.). **Researches on Panama disease.**—*Proc. Ninth West Indian Agric. Conf., 1924*, pp. 51–53, 1925.

An account is given of the experimental work undertaken at the Imperial College of Tropical Agriculture in Trinidad to test the behaviour of the Giant Fig variety of banana [see this *Review*, iv, p. 296], obtained from Grenada (where the Panama disease has not yet been reported), to *Fusarium cubense.* The susceptible Gros Michel banana was employed as a control, both being inoculated by adding infected soil to the holes in which the suckers were planted. The results confirm previous evidence that the Giant Fig is highly resistant to this disease. The characteristic symptoms of wilt developed in the controls, while the introduced variety continued to grow without showing any signs of disease, though it had not reached the fruiting stage at the time of writing.

Reference is made to the author's recent examination of a number

of diseased plants of the Gros Michel and Silk Fig varieties, using media favouring the growth of bacteria, with a view to determining whether the yellow *Pseudomonas* associated with a similar disease in Java [see this *Review*, i, p. 224], could be isolated. *F. cubense* was readily obtained from the discoloured strands in the parent bulbs and the bulbs of the daughter suckers, but there were no bacteria in the yellowed vascular bundles of the leaf sheaths, except, in one case, a common, white, saprophytic species. From a brownish strand in a leaf sheath of one of the diseased Gros Michel plants, *Rhizoctonia solani* was isolated, and from another a species of *Phytophthora*.

CALDIS (P. D.). **A rot of the Smyrna Fig in California.**—*Science*, N.S., lxii, 1598, pp. 161–162, 1925.

The writer spent a considerable amount of time during 1923 and 1924 in the study of a serious rot of Calimyrna figs, which first attracted attention in the autumn of 1922.

The disease, which is known as soft, pink, brown, stem-end, or eye-end rot, is characterized by a more or less extensive water soaking of the skin, accompanied by a bright pink or purple pigmentation. The tissues below such spots, which may cluster round the eye or be irregularly distributed over the sides, are entirely disintegrated, soft and watery, yellowish-brown, and frequently very malodorous. In some cases internal disintegration may occur without any external symptoms.

Diseased tissues contain a hyaline, frequently branching, septate mycelium which can be readily isolated and grown on a number of media, exhibiting extremely variable cultural characters. It fruits abundantly, producing catenulate, short or long, tapering or slightly curved, unicellular conidia on simple or branched conidiophores borne laterally on the hyphae. Numerous inoculation tests showed that this fungus, which has been identified by Sherbakoff as *Fusarium moniliforme*, is the cause of the disease.

The fungus was found throughout the fig-growing sections of California, i.e., the San Joaquin and Sacramento Valleys and the south of the State. The symptoms occur only on the Calimyrna or other caprified figs, and this fact directed attention to the caprifying insect, *Blastophaga psenes*, microscopic examination of the wings and other appendages of which showed the spores of the fungus lodged in considerable numbers among the wing spines, where they had germinated when conditions were suitable.

Cultural and microscopic examinations of individual gall flowers from caprifigs showed that the spores germinate readily and grow on the stigma and style of the flower and on the bodies of the dead insects until the new generation of the latter is ready to emerge. The spores are then carried on the bodies of the female insects into the cavity of the figs and deposited on the stigma, where they germinate and eventually invade the ripening tissues. When the spores are carried on the wings they are generally caught among the scales of the eye, where they produce a dry rot. A similar phenomenon occurs when a number of insects become lodged in the scales as a result of over-caprification.

Brown (Nellie A.). **A note on a rot of the Smyrna Fig in California.**—*Science*, N.S., lxii, 1604, p. 288, 1925.

In connexion with Caldis's paper on a rot of the Smyrna fig in California [see last abstract] the writer points out that the causal organism which was determined by Sherbakoff in January 1925 as *Fusarium moniliforme* [*Gibberella moniliformis*] is liable to confusion with *Oospora verticillioides* when producing only the microconidial type of spores, but it is a quite distinct organism. The fungus has also been called a *Cylindrotrichum*, but the presence of curved, septate *Fusarium* spores in infectious cultures determines its correct classification.

Beizt das Saatgetreide! [Steep cereal seed!]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, v, 9, pp. 71–72, 1925.

In addition to the fungicides recommended in previous lists [see this *Review*, iv, pp. 157, 533] the present paper includes the following preparations for cereal seed disinfection. Segetan-neu (Deutsche Gesellschaft für Schädlingsbekämpfung, Frankfurt a. M.), 0·1 per cent., 30 minutes' immersion, against wheat bunt [*Tilletia tritici* and *T. levis*] and 10 minutes' immersion against the snow fungus (*Fusarium*) [*Calonectria graminicola*]. Urania-saatbeize (Holzverkohlungsindustrie A. G., Constance i. B.) 0·25 per cent., 1 hour's immersion, against wheat bunt, loose smut of oats [*Ustilago avenae*], and the snow fungus; and 0·5 per cent., 2 hours' immersion, against stripe disease of barley [*Helminthosporium gramineum*]. Präparat Sch. 678 (Farbwerke vorm. Meister Lucius & Brüning, Höchst a. M.), 0·25 per cent., 60 minutes' immersion, against wheat bunt and the snow fungus. Urania-saatbeize at the concentration of 0·125 per cent. and 4 hours' immersion, and Sch. 678, 0·1 per cent., 3 hours' immersion, may also be used for the combined control of bunt and loose smut [*Ustilago tritici*] of wheat or of the stripe disease and loose smut [*Ustilago nuda*] of barley.

Fungicidal dusts in general cannot be recommended in the light of the experiments so far made, but the following have given indications of efficacy against wheat bunt in preliminary trials and deserve to be further tested. Abavit (Chemische Fabrik L. Meyer, Mainz), trockenbeize höchst (Farbwerke vorm. Meister Lucius & Brüning, Höchst a. M.), and präparat 490 (Versuchsstation für Pflanzenkrankheiten, Halle a. S.), all at 150 gm. per cwt. of grain.

Nachtrag zum Beizaufruf in Nr. 9. [Supplement to steeping recommendations in No. 9.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, v, 10, p. 83, 1925.

In continuation of the recommendations on fungicides given in the preceding number of the *Nachrichtenblatt* [see last abstract] steeping for half an hour in a 0·75 per cent. solution of betanal (Chem. Fabrik L. Meyer, Mainz) is recommended for the control of the snow fungus (*Fusarium*) [*Calonectria graminicola*]. Kalimat from the same firm is effective against loose smut [*Ustilago avenae*] of oats.

Instead of tillantin B, which is no longer prepared, the Höchst

Farbwerke has introduced the preparation 678 under the name 'nassbeize tillantin'.

The name Hohenheimer Beize has been changed by the Holzverkohlungsindustrie A.G., Constance, to 'urania-saatbeize'.

The dry preparation 490 of the Halle Experiment Station is being made by the Saccharinfabrik, Magdeburg, under the name 'tutan'.

Effective hot water steeping apparatus are sold by the firm Büttner, Uerdingen a. Rh. and the Deutsche Gesellschaft für Schädlingsbekämpfung, Frankfurt a. M.

LEDUC (A.). **La bouillie bordelaise et sa composition chimique.** [Bordeaux mixture and its chemical composition.]—*Scient. Agric.*, vi, 2, pp. 60–64, 1925.

A short discussion of the types of Bordeaux mixture chiefly employed at the present day and of recent work on their chemical composition is given. The author distinguishes between two main views regarding the chemistry of the reactions which occur when copper sulphate and lime are mixed—that of Millardet and his followers who believed that copper hydroxide and calcium sulphate (with some calcium hydroxide if the lime be in excess) are formed, and that of Pickering and other modern investigators who consider that the copper is precipitated in the form of basic sulphates [see this *Review*, iii, p. 285], calcium sulphate being also formed.

He concludes that the actual chemical nature of Bordeaux mixture is still open to doubt, though the evidence is against the views of the earlier school.

PAILLOT (A.). **Sur la préparation d'émulsions d'huiles minérales en bouillies cupriques pour le traitement d'hiver des arbres fruitiers.** [On the preparation of mineral oil emulsions in copper mixtures for the winter treatment of fruit trees.]—*Prog. Agric. et Vitic.*, lxxxiv, 43, pp. 405–406, 1925.

What is stated to be a simple method of preparing a Bordeaux-oil emulsion is described, which permits of the utilization of various oils. The following is the formula employed when petrol is selected: 3 kg. copper sulphate, 4 kg. hydrated lime, 10 l. petrol, 90 l. water. The directions are as follows:

(*a*) Dissolve the copper sulphate in 25 l. of water; (*b*) make a milk of lime in warm water at the rate of 4 kg. per 5 l. of water. The petrol is poured slowly into the milk of lime whilst still warm, stirring the whole time. Dilute the thick paste thus obtained in 10 to 15 l. of water; pour into the solution (*a*), and make up to 100 l. while stirring.

This emulsion retains its stability for a considerable time. No separation of the oil was observed, even after several weeks had elapsed. The addition of adhesives such as casein or sulphoricinate of soda is stated to be unnecessary. The ordinary spray machines can be used without difficulty.

Experiments are stated to have shown that the lubrication oils used for motor cars, especially the fluid and semifluid types, can be substituted for petrol with advantage.

Yothers (W. W.) & Winston (J. R.). **Preliminary report on colloidal clays as emulsifiers for mineral oils used in spraying citrus groves.**—*Journ. Agric. Res.*, xxxi, 1, pp. 59–65, 1925.

Soap-mineral oil emulsions are open to the objection that they are not sufficiently stable to mix with hard water or with lime-sulphur solution unless the emulsions themselves are treated with a stabilizing agent. Glue, casein, milk powder, flour, starch, and water-glass have been used for this purpose, but it has been found that if the organic materials are added to the emulsions any considerable time before use, fermentation usually takes place. Experiments carried out with a number of inorganic materials have shown that kaolin, fuller's earth, and other colloidal clays may be used instead of soap in making emulsions for spraying citrus trees. These emulsions will mix with hard water or any spray combination without special treatment, will keep for at least three months, and cost much less than the soap emulsions. There appears to be greater liability to damage, however, when an emulsion is combined with lime-sulphur solution than when the two are applied separately. Trials with kaolin lime-sulphur oil emulsion on young orange trees caused considerable defoliation, and when fuller's earth was used in place of kaolin very severe damage resulted.

Robinson (R. H.). **Spreaders for spray materials, and the relation of surface tension of solutions to their spreading qualities.**—*Journ. Agric. Res.*, xxxi, 1, pp. 71–81, 1925.

In order to correlate the surface tension values of various materials with their spreading properties, surface tension determinations of numerous substances were made with an apparatus devised by Fahrewald, giving an accuracy of 0·1 dyne-cm. All measurements were made at 25° C. and about three minutes were allowed for the development of partial static tension before the measurement was recorded. The results obtained are given in tabular form. These substances were then used in spraying apple, pear, and prune leaves and apple fruit with an atomizer, and the degree of spreading ('good', 'medium', 'poor', and 'none') was observed. A comparison of the surface tension values of the different substances in solution with their spreading qualities showed no consistent relationship; other factors beside surface adsorption must, therefore, affect the spreading qualities of a solution.

The interfacial tension between paraffin oil, having a specific gravity of 0·869 at 20° C., and the substances used was next determined and it was found that the interfacial tension values are not proportional to the spreading properties of the various materials. Low surface or interfacial tension values, however, indicate, in general, surface adsorption, and all substances showing this phenomenon probably have spreading qualities.

Generalizations on the spreading qualities of any particular substance are difficult, owing to the variable results obtained with leaves of different hosts, and of different age on the same host. The most satisfactory materials tested were (*a*) soaps, (*b*) substances containing water-soluble or colloidal solutions of proteins, the former usually requiring much higher concentrations than the latter to

effect equal spreading. The force necessary depends upon the concentration of the protein, being greater for the lower concentrations and less for the higher ones. The soluble protein is probably the active spreading agent, and, of the many substances tested, skim milk neutralized with hydrated lime, and certain other milk products, appear to be the most suitable materials for practical purposes.

The amount of lead arsenate adhering to the leaf was approximately the same whether a spreader was used or not, and, for the most part, was proportional to the concentration used.

GOODWIN (W.) & MARTIN (H.). **An investigation of the chemical changes taking place in the mixed lime sulphur-lead arsenate spray.**—*Journ. Agric. Science,* xv, 3, pp. 307–326, 1925.

The authors review previous investigations on the effects of mixing lead arsenate with lime-sulphur, and describe experiments carried out with the object of establishing the extent and nature of the reactions which occur in such mixtures at and after using, and their effect on the fungicidal and insecticidal value and the risk of spray injury. The preparations used were commercial lime-sulphur and lead arsenate paste consisting mainly of the acid arsenate. The methods of analysis employed are fully explained.

It was found that the reaction which took place on mixing was slight, and was such as to have little effect on the chemical properties of either material as a spray.

The oxidation of the lime-sulphur after spraying proceeds according to the empirical formula $CaS.S_x + 3O = CaS_2O_3 + S_{x-1}$ and the calcium sulphides are hydrolized in aqueous solution. The addition of lead arsenate has no effect on the amount of sulphur precipitated by oxidation.

Lead arsenate was found to be only slightly decomposed by lime-sulphur or by the oxidation products of the latter, but in the presence of carbon dioxide the sulphuretted hydrogen produced causes a marked decomposition of the lead arsenate, causing an increase in soluble arsenic which may lead to spray injury.

The fungicidal value of the mixed spray, as tested by its action on hop mildew [*Sphaerotheca humuli*], is not less than that of lime-sulphur alone, and may be greater owing to the presence of soluble arsenates and thioarsenates.

GOODWIN (W.) & MARTIN (H.). **The chemical effect of the addition of a 'spreader' to the mixed lime sulphur-lead arsenate spray.** —*Journ. Agric. Science,* xv, 4, pp. 476–490, 1925.

In connexion with their investigations on mixed sprays [see last abstract] the authors studied the effects of adding casein, lime, lime-casein, or gelatine separately to a mixed lime sulphur-lead arsenate spray.

The addition of casein or gelatine was found to cause an increase in the amount of soluble arsenic formed when the spray decomposed, but no change in the reactions of the polysulphide sulphur.

Lime caused a decrease in the soluble arsenic and reduced the fungicidal value of the spray owing to its reaction with the sulphur liberated from the calcium sulphide.

When lime-casein was added the fungicidal value was reduced if there was much free lime in the spreader, whereas when only a small excess was present there was little effect on the reaction of the polysulphide sulphur and an increase in the soluble arsenic.

The rate of decomposition of the mixed spray is retarded by the addition of any one of these materials.

FISCHER (E. W.) & SCHARRER (K.). **Ueber ein neues Verfahren der Saatgutbeize.** [A new method of seed steeping.]—*Chem. Zeit.*, xlix, 108, pp. 757–758, 1925.

The writers have devised a process of seed steeping which they believe obviates the disadvantages of the liquid solutions and dusts in common use.

Experiments with various liquids having a lower boiling-point than water showed that trichlorethylene (C_2HCl_3) and, under certain conditions, carbon tetrachloride (CCl_4) are eminently adapted to use as seed steeps. Flax seed immersed for half-an-hour or one hour in either of these solutions dried a few minutes after removal without the usual formation of slime. The germination of the seed was improved and parasitic attacks prevented.

A special apparatus, worked by hydraulic pressure, has been devised for the application of these solutions, the requisite amount of which has thereby been reduced to a minimum in view of their high cost.

MÜLLER (H. C.) and MOLZ (E.). **Ueber die Trockenbeize des Saatgutes.** [On the dusting of seed.]—*Deutsche Landw. Presse*, lii, 35, p. 416, 1925.

In the autumn of 1924 a large number of fungicidal dusts were tested at numerous German agricultural experiment stations under the general supervision of the Biologische Reichsanstalt.

Only three of these preparations can be tentatively recommended for the control of bunt of wheat [*Tilletia tritici* and *T. levis*], namely, abavit, trockenbeize höchst, and präparat 490, all applied at the rate of 150 gm. per l. of seed [see above, p. 113]. The last-named cannot yet be placed on the market owing to technical difficulties in connexion with its manufacture.

Porzol [see this *Review*, iv, p. 273] and uspulun dust cannot be recommended on the basis of these tests.

The use of the Primus apparatus devised by the writers in co-operation with the engineering firm of G. Drescher, Halle, is recommended. This machine treats about 10 cwt. of seed grain per hour.

Further preliminary experiments (to be continued in the autumn of 1925) indicated that good control of loose smut of oats (*Ustilago avenae*), *Fusarium* disease of rye [*Calonectria graminicola*], root rot of beets [*Phoma betae*], and stripe disease of barley [*Helminthosporium gramineum*] can be obtained by dusting.

The advantages of dusting over spraying are briefly discussed, and the risk of using commercial preparations which have not received official sanction is emphasized.

ALLEN (JESSIE M.). **Author and subject index of the publications on plant pathology issued by the U.S. Department of Agriculture up to January 1, 1925.**—*U.S. Dept. of Agric. Library, Bibliographical Contributions,* 8, 158 pp., 1925. [Mimeographed.]

This publication is stated to give a complete list of all literature issued by the Federal authority in the United States up to January, 1925, on the subject of plant pathology, with the exception of diseases caused by insects. All papers are listed under the author's name and again under their subject matter.

CARNE (W. M.). **A preliminary census of the plant diseases of South-Western Australia.**—*Journ. Roy. Soc. Western Australia,* xi, 7, pp. 43–68, 1925.

The author gives a brief account of the climate and geographical features of the area covered in this survey, which forms a triangle, the base of which extends from the Murchison River to a little east of Esperance and coincides with the 10-inch isohyet representing roughly the eastern limits of cultivation, while the other two sides are formed by the ocean. This is followed by a list of the principal diseases of cultivated and wild plants recorded in the area, with indications of their causes where known, their distribution and prevalence, and their economic importance. It is pointed out that the isolation of this area by a wide uncultivated and semi-desert belt has probably tended to restrict the number of parasitic plant diseases.

TROTTER (A.). **Il concetto di aborto in patologia vegetale.** [The concept of abortion in plant pathology.]—*Ann. R. Scuola Sup. di Agric. in Portici,* 2nd Ser., xx, *1924–1925,* pp. 3–11, 1925.

The author discusses the various definitions of abortion (including suppression, degeneration, and the like) and points out that the term has been used to cover cases of sterility in plants by various authors. Strictly speaking it should be applied to the death of the embryo after fertilization and not to cases involving alterations to the sexual organs which lead to a condition of sterility. From a pathological point of view, it is necessary to distinguish these two conditions and not confuse genuine parthenocarpy or aspermia with the abortion of fertilized seeds.

The author has studied cases of the atrophy of hazel nuts, pistachios [*Pistacia vera*], almonds, apricots, and walnuts, and observed the following conditions: the atrophy may appear at any stage from the ovule to the half-formed seed; it may affect the whole seed or be limited to the cotyledons or the embryo. In such cases the pericarp may develop normally. These abnormalities may have considerable economic importance, especially in nuts. They may depend on various causes, such as an inadequate supply of plant nutrients or insufficient vitality of the sexual organs or possibly varietal degeneration. True parthenocarpy may be explained by the possible dissociation of two functions of the pollen, one vegetative, and having a stimulating action on the ovary, and the other sexual, each of which may act independently.

JOHNSON (J.). **Transmission of viruses from apparently healthy Potatoes.**—*Wisconsin Agric. Exper. Stat. Res. Bull.* 63, pp. 1–12, 8 pl., 1925.

As a result of cross-inoculation studies it was found that symptoms of three types of virus diseases could be produced in tobacco and several other solanaceous hosts by inoculations from apparently healthy potatoes [see this *Review*, iv, p. 449].

Out of 965 inoculations on tobacco from the foliage of 170 healthy Triumph potatoes (over 50 of which were from stock indexed for mosaic the previous season and grown in isolated plots) [see this *Review*, iv, p. 656], 70 per cent. were successful in causing symptoms of these diseases, every one of the 170 potato plants proving infectious. From other healthy potatoes of different varieties and origins (from Maine to Florida and Oregon) 55 per cent. of infections were obtained. There were no marked differences in the symptoms from the different potato varieties. Inoculations from the tubers, whether of healthy or diseased plants, gave 38 per cent. of infections. When the tuber inoculations failed, inoculations from foliage grown from these tubers succeeded.

These three diseases are referred to as 'mottle', 'spot-necrosis', and 'ring-spot', but some evidence was obtained that the first two may be caused by the same virus, since 'spot-necrosis' often develops with increasing severity after the transfer of the 'mottle' form through one or more generations on tobacco. On inoculation direct from potato, the first symptom is usually a faint mottling which differs markedly from that of the ordinary tobacco mosaic, appearing only on the older leaves. Subsequent transfers from tobacco to tobacco may cause marked necrosis and stunting, and the spot-necrosis form is developed. This form can also be transmitted back to potato, sometimes with 100 per cent. of successes, causing a virulent and often fatal disease unlike ordinary potato mosaic, although 'mottle' and 'ring-spot' give no symptoms when thus transferred back. The 'ring-spot' form is considered to be entirely separate, being obtained chiefly from the Rural New Yorker variety of potato and only under very favourable conditions.

The inoculations were made on tobacco grown at 27° to 32° C. from potatoes grown at 17° to 22°, the material used being mostly crushed foliage juice, inoculated by needle pricks in the leaf blades and midribs. The tobacco was nearly all the Connecticut Havana No. 38 variety, but other varieties tried behaved similarly. The symptoms produced were much the same whether the inoculum came from apparently healthy or obviously mosaic diseased potatoes. Repeated passage through tobacco increases the virulence of the infection, yielding a higher percentage of successes in each transfer up to two or three. Attempts to infect potatoes with the ordinary tobacco mosaic failed, though sometimes dark necrotic lesions were caused.

Investigations proved that the properties and nature of these viruses are similar to those of other well-known virus diseases of plants with respect to filtration, dilution, insect transmission, and resistance to desiccation, putrefaction, heat, and chemicals. They are less readily transmitted by aphids and less resistant to heat and drying than that of ordinary tobacco mosaic.

No disease resulted from inoculations of extracts from other species of healthy plants; neither were these diseases produced in tobacco inoculated from the foliage of potatoes grown from true seed.

Infection with one or more of these potato virus diseases was secured on every solanaceous host tested, including tomato, eggplant, and chilli pepper (*Capsicum annuum*), but the symptoms produced tended to differ according to the host.

An experiment was also conducted in which the viruses from healthy potatoes were combined with ordinary tobacco mosaic virus and inoculated into tobacco, tomato, and other solanaceous plants. The result was a very malignant form of disease, sometimes fatal, particularly when 'spot-necrosis' made one of the combination.

From these experiments the author concludes either that potatoes are almost universally 'true carriers' of viruses, or that the potato protoplasm itself is actually the causal agency of one or more virus diseases of tobacco and other solanaceous plants.

LA RUE (C. D.). **Loss of virulence in fungi.**—*Science*, N.S., lxii, 1600, pp. 205–206, 1925.

A theory is propounded to explain the loss of virulence of fungi in culture such as occurred in the case of Burkholder's *Fusarium* [*martii phaseoli*: see this *Review*, iv, p. 570]. It is suggested that when a normally parasitic fungus is grown as a saprophyte, mutations occur which give rise to saprophytic strains. The latter thrive, while the more actively parasitic strains tend to die out, with a resulting loss of infecting power in the culture. When again grown as a parasite, the fungus will regain its virulence through the development of parasitic strains originating as mutations, while the saprophytic strains will perish.

The proposed theory may also serve to explain the attenuation of bacteria.

None of the sudden changes observed in fungi has been studied cytologically, and it is therefore unknown whether they are explicable on the basis of chromosome behaviour. Hence the term 'mutations' is used for convenience.

Further studies on known cases of loss of virulence are planned and well-authenticated records of such phenomena would be welcomed by the author in this connexion.

ZIMMERMANN (A.). **Sammelreferate über die Beziehungen zwischen Parasit und Wirtspflanze. Nr. 2. Die Uredineen.** [General review of the relations between parasite and host plant. No. 2. The Uredineae.]—*Centralbl. für Bakt.*, Ab. 2, lxv, 14–21, pp. 311–418, 8 figs., 1925.

This exhaustive discussion, in conjunction with citations from the principal literature on the subject, of the relations between parasite and host in the Uredinaceae, is based on the same lines as the author's previous work on the Erysiphaceae [see this *Review*, iv, p. 304].

Section I deals with the development of the parasite on and in the normal host and comprises an account of the germination of the spores and their penetration of the host; development within the

latter; and the mycoplasm theory. In section II the effects produced by the parasite on the host are discussed. Section III is devoted to the physiology of the development of the parasite independent of the host (spore germination and formation of mycelium). In section IV the various stimulation phenomena (tropisms) are described. Section V deals with the behaviour of the parasites on and in antagonistic species. In section VI an account is given of specialization in the Uredinaceae and the determination of the varying degrees of resistance in the host. Section VII treats of the influence of the development of the host and of external conditions on the evolution of the parasite, embracing the following factors: age of the organs attacked; age of the host; state of health of the host; climatic conditions; assimilatory capacity of the host; dependence of teleutospore formation on the development of the host and on external conditions; overwintering of the Uredinaceae; and spore dissemination by wind. In section VIII the virulence of the parasites is discussed. Section IX contains observations on the inheritance of resistance in the hosts (including hybrids and grafts). Section X is devoted to a discussion of the causes of immunity and resistance, as conditioned by the anatomical and physiological properties of the host, and the chemical relations between parasite and host.

A bibliography of over 300 titles is appended.

Ritzema Bos (J.). **De ontginningsziekte en haar bestrijding.** [The reclamation disease and its control.]—*Tijdschr. over Plantenziekten*, xxxi, 10, pp. 233–244, 1925.

According to a paper by Hudig and Meyer in *De Veldbode* (25th January, 1925), the so-called 'reclaimed moor' disease [see this *Review*, iii, p. 425] may be controlled by the application of urban refuse at the rate of 50,000 to 80,000 kg. [? per hectare], according to the humus content of the soil, the latter quantity being necessary in 'black' soils containing 30 per cent. humus. In most cases similar results can be obtained by the addition of stable manure or other organic matter to the compost heap, which should then be allowed to stand for two months; in this case only one-fifth of the above-mentioned quantities need be given.

Preliminary experiments indicate that the application of 60 kg. copper sulphate per hect. is also likely to give very effective control.

Murphy (P. A.) & McKay (R.). **Investigations on the leaf-roll and mosaic diseases of the Potato.**—*Journ. Dept. Lands and Agric. Ireland*, xxv, 2, pp. 138–154, 5 figs., 1925.

In 1924 and 1925 the authors continued their investigation of leaf roll and mosaic diseases of the potato [see this *Review*, iii, pp. 160, 601] at Glasnevin, near Dublin.

In view of the difficulties previously encountered in carrying out infection experiments in the open, owing to accidental infections from outside sources, the greater part of the work of a critical nature was done in an insect-proof greenhouse, where both inoculated and control potatoes were grown for a season. This method, besides allowing of gathering extensive information on the state of

health, the diseases present, and the success or failure of the experimental infections, which was checked by planting the progeny in the open plots in the following season, has the further advantage of allowing time for both primary and secondary symptoms to appear. It does not entirely exclude the necessity of making certain experiments on open plots, such as, for instance, those on sprouting tubers and the elimination of disease from partially affected crops, but, as a rule, potatoes once planted in the open cannot again be used for seed purposes because of the danger of the healthy plants contracting the infection, and of the pure lines of disease becoming mixed. The system of inoculating tubers during the winter, planting them out in the field in the spring, and making observations during June and early July, was employed to a less extent than in the previous work, since it was found that the plants were thus under observation for too short a time, and experience showed that it was not entirely satisfactory to dig up the tubers even early in July in order to observe the plants in the next generation. A new and improved method (to be described elsewhere) of tuber grafting was also devised for transmitting the infection to the potatoes tested, and is claimed to give more reliable results than the method of inoculation by means of carrier aphids.

Some details are given of the experiments started in the autumn and winter of 1923 with a view to testing Schander and Richter's statement [see this *Review*, iii, p. 99] that the presence in the tubers of leaf roll and of certain types of mosaic and 'curl' makes itself felt by a marked weakening of the sprouts. The technique described by the German authors was strictly adhered to. Thirty-three lots of potatoes, belonging to five named varieties, were used, representing many gradations in the amount of the disease present. The results obtained in 1924 indicated that the presence of mosaic, such as existed in the experiments, has no material influence tending to reduce sprouting energy, the evidence pointing rather in the other direction, although the difference is not believed to be significant. In no case was a segregation of diseased from healthy plants effected. The results were analysed in various other ways, but no correlation could be found between the sprout index number (as defined by Schander and Richter) and the presence of disease. The average index number of tubers diseased with leaf roll (or leaf roll and mosaic) was, indeed, in most cases appreciably lower than that of healthy tubers, but the variations in both cases were so wide that a great deal of overlapping took place, and diseased and healthy plants occurred over practically the whole range of values covered. It is claimed that the results showed that Schander and Richter's method also fails in the less exacting requirement of distinguishing between lots of the same variety containing widely different amounts of virus diseases and showing very different cropping powers, and also the impossibility of fixing a standard index number below which the presence of disease, or unproductivity, is to be presumed. These results were further confirmed in 1925.

It is evident that many factors must influence the sprouting capacity of potato tubers, including, probably, the season, locality,

and conditions of growth, manuring, maturity, size of tuber, and variety. It was determined experimentally that sprouting late in the spring as compared with earlier sprouting increased the sprout index by approximately 40 per cent., while a removal of the sprouts, twice repeated, increased the index by 42 per cent., the same tubers being used throughout. On the other hand, the medium in which the tubers were sprouted, whether in sand or in darkness in air, made no ultimate difference, except that the process was slower in the air. Whatever effect virus diseases may have on the energy of sprouting—which is apparently small—it is frequently so masked by that of other factors that it is not possible to grade commercial samples of seed potatoes for their disease content or probable productivity by reference to the vigour of their sprouts.

Further experiments were made to test the effect on the progeny of the method of removing healthy plants from among diseased ones, instead of roguing out the latter, and of preserving their produce for seed purposes. The results showed that a very large proportion of the tubers dug on 5th July produced healthy though not vigorous plants, but that infection had reached some of the tubers even then. The proportion of tubers infected after a further two weeks was considerably greater, while among the tubers dug in October the percentage of disease was at its maximum. It is therefore concluded that the only hope of saving sound seed from healthy plants in a partially diseased crop is by digging selected plants at a very early date.

A description is given of the method followed for some years at Glasnevin for procuring and maintaining healthy stocks of potatoes for experimental purposes, which shows that the deterioration that sets in soon after potatoes are introduced into the Dublin area is not an inevitable one, and that it is not inseparably connected with the soil, climate, or other conditions of the district. This is exemplified by the fact that some varieties of potatoes, e.g., Arran Victory, have been maintained by isolation and roguing for upwards of four years in their original productive condition, while the same, grown under ordinary farm conditions, have now approximately 100 per cent. infection with virus diseases.

Reference is made to the suggestion often repeated that the susceptibility of a potato variety to virus diseases is a measure of its probable duration of life. The authors are inclined to think that reaction to virus diseases, mainly mosaic, after infection, in other words tolerance of these diseases, is of greater importance than actual resistance to infection. Examples are quoted, in support of this view, of such tolerant varieties that may show typical spotting early in the season, and again in August and September, but the reduction in vigour of which is not at all marked. Work is now in hand to test this theory.

The concluding sections of the paper contain a discussion of the causes that determine the success or failure of infection by means of aphids, which have proved most uncertain agents of transmission in the authors' experiments, while all attempts to discover the factors responsible for this have failed; an account of experiments to ascertain the origin of the aphids in stored potatoes, which show that the source of infestation by these insects is to be sought in the

when they are harvested; and, finally, details of experiments that supply a further and convincing proof that leaf roll, and, apparently, diseases of the mosaic group, are occasionally conveyed by true seed.

Auftreten des Kartoffelkrebses im Elsass. [Occurrence of Potato wart disease in Alsace.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, v, 10, pp. 81–82, 1925.

The *Badische Nachrichten* of 9th September, 1925, states that great uneasiness has been caused throughout the Breuschtal district of Alsace owing to the appearance of the potato wart disease [*Synchytrium endobioticum*]. The destruction of the entire crop and turning over the land to a depth of a metre has been ordered.

Auftreten des Kartoffelkrebses in der Schweiz. [Occurrence of Potato wart disease in Switzerland.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, v, 10, p. 82, 1925.

The *Baseler Nachrichten* of 13th August, 1925, reports the discovery of potato wart disease [*Synchytrium endobioticum*] near Lörrach, for the first time in Switzerland, by the Oerlikon (Zurich) research station. About half an acre is infected.

DICKSON (B. T.). **Colletotrichum v. Vermicularia.**—*Mycologia*, xvii, 5, pp. 213–217, 1 pl., 1925.

In this paper the author describes the result of his study of specimens of four species of *Vermicularia* occurring on the potato, received from the Kew Herbarium, in comparison with the potato black spot organism formerly known as *V. varians*.

V. maculans (Link) Desm. was found to be a *Colletotrichum*, as the spores occur in acervuli with no evidence of sporodochia or pycnidia. The species is renamed *C. maculans* and the description amplified.

V. atramentaria B. and Br. is stated to have been correctly renamed *C. atramentarium* (B. & Br.) Taub., the author citing *C. solanicolum* O'Gara as a synonym but not *Phellomyces sclerotiophorus*, as suggested by Taubenhaus (*Mem. N.Y. Bot. Gard.*, 6, p. 534, 1916). It differs from *V. maculans* in that it has short cigar- or torpedo-shaped spores, instead of spores shaped like a glume or life-boat.

V. minuta (Link) Lib. and *V. orthospora* Sacc. & Roum. also have the characters of *Colletotrichum*, to which genus both species are transferred.

V. varians Ducomet has already been shown to be the same as *C. tabificum* (Hall. p. p.) Pethybr. [see this *Review*, iv, p. 70] and studies in the author's laboratory have confirmed this and have further shown that it is identical with *C. atramentarium*, which is regarded as the correct name [see this *Review*, iv, p. 699].

Ontsmetting van Aardappelen met sublimaat. [Disinfection of Potatoes with sublimate.]—*Tijdschr. over Plantenziekten*, xxxi, 10, pp. 221–223, 1925.

Full directions are given for the control of *Rhizoctonia solani* on potatoes by means of immersion in corrosive sublimate [see this *Review*, ii, p. 572].

Scientific research notes. Leaf disease.—*Bull. Rubber Growers' Assoc.*, vii, 10, pp. 606–607, 1925.

It is stated by Pinching that a leaf fall disease of *Hevea* rubber still continues to cause trouble in the plantations of southern Perak, Malaya. Investigations by Sutcliffe indicate that the causal fungus is a species of *Gloeosporium*, but that the latter probably follows some other primary parasite. It is stated that the Ceylon Rubber Research Mycologist, in his Report for March 1925, also recorded the constant presence of a species of *Gloeosporium* in cultures made from affected leaves in Ceylon. No trace of *Oidium* [? *O. heveae*] was found in connexion with this leaf fall disease in Perak. More recent cultures by Sutcliffe from affected leaves and flowers revealed the presence of two other fungi besides the *Gloeosporium*, namely, a species of *Fusarium* and a Phycomycete. It is thought that the last organism may be the true cause of the disease.

Brown (W.). **Report on further experiments on the spotting of crepe Rubber.**—*Bull. Rubber Growers' Assoc.*, vii, 9, pp. 522–532, 1925.

Further investigations [the technique of which is described] into the spotting of crepe rubber in relation to certain active fungi such as *Fusarium* and *Penicillium* [see this *Review*, iv, p. 311] have been carried out at the Imperial College of Science and Technology, London. Experiments were made with a view to intensifying the spotting effects in order to obtain more rapid and certain methods of prevention.

A definite increase in the rate and intensity of spotting was produced under artificial conditions by increasing the water content of the crepe.

This was done by increasing the temperature of the water in which the rubber was soaked. At laboratory temperature (17° C.) dry crepe rubber takes up only about 10 per cent. of water, whereas at 47° it will take up about 25 per cent. in four days. Tests of various nutrient substances showed that spotting was most intense when the rubber was placed in a medium containing ammonium salts. By placing rubber that had been soaked in water at 47° for three to four days in a few c.c. of a 0·2 per cent. solution of ammonium chloride and then inoculating with the *Fusarium* (a species regarded by Wollenweber as close to or identical with *F. javanicum*) an intense violet colour develops in three days at 30°. The acetone extractable constituents of rubber evidently play an important part in the phenomenon of spotting. Acetone extracted rubber took up less water and showed only feeble spotting reactions as compared with the intense colour developed by the untreated material.

A temperature of 30° C. appears to be the optimum for spotting in the case of the two fungi dealt with in this paper. The maximum temperature for spore germination is about 37°. A rise of a few degrees in the temperature of the drying sheds should, therefore, effectively prevent spotting. To raise the temperature unnecessarily high is, however, dangerous, and causes general discoloration of the sheets. Rapid drying is another effective method of preventing spotting, though even with a low water content some spotting will

abstract] of 0·01 per cent. inhibited the germination of both fungi tested and was most effective when used as a neutral or faintly acid solution. It was about ten times as effective as phenol itself.

STEVENS (H. P.). **Paranitrophenol as a mould preventive.**—*Bull. Rubber Growers' Assoc.*, vii, 9, p. 560, 1925.

Recommendations are now given for the control of mould or rust on sheet rubber and spots in crepe rubber by means of paranitrophenol [see this *Review*, v, p. 53] either by soaking the freshly rolled sheet in a 0·1 per cent. solution (approximately 3¼ oz. in 20 galls. water) for three hours or by dissolving the paranitrophenol in the dilute acid used for coagulating the latex (e. g., using a mixture of 5 oz. acetic acid and 1·5 oz. paranitrophenol in 10 galls. water). At present prices the cost of the soaking process is about 0·133 cents (about 0·037 of a penny) per lb. and that of the coagulating process about 0·18 cents (about 0·05 of a penny) per lb.

The second process is preferable to the first for crepe rubber, provided that sufficient care is exercised to prevent undissolved particles getting into the latex. Attention is drawn to the importance of not using the water reserved for diluting the latex for dissolving the paranitrophenol.

STEVENS (H. P.). **Coagulation with sodium silico-fluoride in conjunction with paranitrophenol.**—*Bull. Rubber Growers' Assoc.*, vii, 11, pp. 657–658, 1925.

Tests of paranitrophenol as an antiseptic for prepared rubber [see last abstract] have been carried out on rubber coagulated with sodium silico-fluoride. The latter substance has been found to be effective in preventing the appearance of 'bubbles' in sheet rubber, due to fermentation in the factory.

The paranitrophenol was used dry and ground up with the sodium silico-fluoride before being added to the latex. Specimens so treated gave satisfactory results as regards breaking strength, and were superior to specimens treated with sodium silico-fluoride alone in regard to the rate of cure, which is ordinarily a little slower with this substance than with acetic acid. If this latter point be confirmed by further tests, a combination of sodium silico-fluoride and paranitrophenol will furnish the planter with a cheap and efficient coagulant, yielding a rubber vulcanizing at a similar rate to that obtained with acetic acid, but free from any tendency to contain bubbles, to go mouldy, or to become 'rusty'.

SALMON (E. S.). **Notes on a visit to the Hop-growing districts of Bohemia, Czechoslovakia.**—*Journ. Inst. of Brewing*, xxxi, 10, pp. 514–521, 1 pl., 1925.

This paper contains the following observations of phytopathological interest made during the author's visit to Czecho-Slovakia in the summer of 1924.

Fungous diseases appear to be a relatively unimportant factor in Bohemian hop-gardens. Mould or mildew (*Sphaerotheca humuli*) was only observed on wild hops in the Saaz (Zatec) and Auscha districts.

A disease resembling canker was observed at Ploschkowitz. The causal organism apparently was a species of *Fusarium* with tri-

septate conidia measuring 44 to 54 by 4 to 8 μ. These dimensions considerably exceed those of the species associated with a similar disease in England [see this *Review*, ii, p. 132].

No trace of mosaic disease was detected, but a disturbance which is apparently of the virus type was noticed in the Saaz district, where it is known as 'curl'. The symptoms are stated to appear after the attacks of a species of flea-beetle, to the poisonous effects of which the disease has been ascribed. In the writer's opinion the trouble closely resembles the nettlehead or 'eelworm' disease occurring on Fuggles hops in Kent and Sussex [see this *Review*, iv, p. 634]. The affected plants in Czecho-Slovakia show the characteristic incurving of the leaf margins and the shortening and partial sterility of the stems, while an additional system consists of dead areas and holes in the leaf tissue. As in England, the disease affects only isolated groups of plants, and so far appears to be of no great economic importance. The writer was informed that in two other localities of the Saaz district the disease has been known for thirty years or more; that it occurs only in certain soils; and that it persists in the ground. In these parts crop rotation with potatoes or roots is practised in the affected areas. In an experimental garden the disease was observed on Kent Goldings, Cobbs, and Early Bird.

LINDEMANS (P.). **The downy mildew of the Hop.**—*Petit. Journ. du Brasseur*, xxxiii, pp. 899–901, 1925. [Abs. in *Journ. Inst. of Brewing*, xxxi, 10, p. 526, 1925.]

The symptoms and distribution of downy mildew of hops (*Pseudoperonospora humuli*) [see this *Review*, iv, p. 566] are described. The disease is stated to have been severe in Belgium during 1925, the most susceptible variety being the Hallertau, while an imported Kentish hop seems to be almost immune.

SPEGAZZINI (C.). **Ficomiceteas argentinas nuevas ó críticas.** [New or critical Argentine Phycomycetes.]—*Rev. Argentina Botan.*, i, 2–3, pp. 87–93, 1925.

Notes are given on 15 Phycomycetes from the Argentine, of which 7 are new species.

Urophlyctis platensis n. sp. causes the development of dense, reddish-yellow, botryose galls on the stems and leaves of *Trifolium polymorphum* near La Plata. This species is distinguished from *U. trifolii* by the extreme thickness of the oosporal epispore (25 to 50 μ). The galls are 1 to 10 mm. long by 0·5 to 1 mm. broad, and are formed by numerous subglobose cystidia, measuring 250 to 500 μ in diameter and with a reddish, smooth, delicate wall. One or two globose oospores, 150 to 200 μ in diameter, with a smooth colourless wall and golden yellow contents are contained in each cyst.

U. vagabunda (*U. alfalfae* Speg. non Lagerh. Myc. Argent. No. 325, *Protomyces vagabundus* Speg. Phyc. Argent. No. 38) causes a similar gall formation on the leaves and stems of *Medicago denticulata* and *Adesmia punctata* near La Plata. The galls are generally isolated, scattered, small (0·5 to 3 mm. in diameter) and ferrugineous in colour. Each gall consists usually of a group of 1 to 20 globose cysts or hypertrophied cells, 100 to 150 μ in diameter and contain-

ing 3 to 10 oospores. The latter appear rounded when seen from above, and 38 to 44 μ in diameter, while when viewed from the side they are hemispherical and 20 to 22 μ across. They have an undulated, subverrucose epispore, with deep orange-coloured contents.

During the summer of 1919 a parasitic fungus caused considerable damage to *Capsicum grossum* and to *Lycopersicum esculentum* in La Plata. It caused round, concave, withered blotches (2 to 7 mm. in diameter) with yellowish or dull grey, concentric wrinkles on the nearly ripe fruits, from which a hyaline gum was generally exuded. The fungus formed cinnamon-coloured, smooth, pear-shaped sporangia, 65 to 100 by 20 to 30 μ in diameter and with an obtuse apex in which there was a scarcely visible ostiole. The base was enlarged into a kind of foot, on which 3 to 7 hyaline, lateral branches of irregular form were borne. These gave rise to an unseptate mycelium, with hyphae from 2 to 4 μ in thickness, which penetrated the tissues. The zoospores completely filled the zoosporangium and were minute, globose, and smoky in colour. This fungus is referred with doubt to the genus *Haplocystis* as *H.* (?) *vexans* n. sp.

SPEGAZZINI (C.). **Uredineas argentinas nuevas ó críticas.** [New or critical Argentine Uredineae.]—*Rev. Argentina Botan.*, i, 2–3, pp. 93–145, 1925.

Amongst the 132 rusts on which notes are given in this paper, a number of new species are included, with Latin diagnoses. Most of the rusts of economic plants mentioned are already known either from the author's previous writings or from those of other mycologists.

SPEGAZZINI (C.). **Ustilagineas argentinas nuevas ó críticas.** [New or critical Argentine Ustilagineae.]—*Rev. Argentina Botan.*, i, 2–3, pp. 145–160, 1925.

Seven of the 33 smuts enumerated are described as new species, with Latin diagnoses. Critical notes are given on most of the others.

GONZÁLEZ FRAGOSO (R.) & CIFERRI (R.). **Hongos parásitos y saprófitos de la República Dominicana.** [Parasitic and saprophytic fungi of the Dominican Republic.]—*Bol. R. Soc. Esp. Hist. Nat.*, xxv, 8, pp. 356–368, 6 figs., 1925.

Among the parasitic and saprophytic fungi collected, mostly by Ciferri, in the Dominican Republic and enumerated, with Latin diagnoses in the case of new species, in the present paper, the following are of special interest. *Kuehneola fici* on the leaves of fig (*Ficus carica*); *Meliola amphitricha* on leaves of guava (*Psidium guajava*); *Sphaerulina hainaensis* n. sp. ad. int. on dry leaves of tobacco (*Nicotiana tabacum*), associated with, and probably the perfect stage of, *Phyllosticta hainaensis* n. sp. ad. int.; *Ciferria coccothrinacis* n.g., n. sp., on apical leaves of *Coccothrinax argentea*; *Sphaeropsis paradisiaca* nov. var. *minor* on plantain leaves (*Musa paradisiaca*); *Pestalozzia espaillatii* on mangosteen (*Garcinia mangostana*); *Cercospora cruenta* on leaves of cowpea (*Vigna sinensis*); and *C. coffeicola* on leaves of coffee (*Coffea arabica*).

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

Vol. V MARCH 1926

Lee (H. A.) & Martin (J. P.). **The cause of red-stripe disease of Sugar Cane.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 1–8, 2 figs., 1925.

Isolations, made in 1924 in the pathological laboratory of the Hawaiian Sugar Planters' Association in Honolulu, from diseased tissues of sugar-canes affected with red stripe disease [see this *Review*, iv, p. 567], established the constant association with the disease of two bacterial forms: (A) which formed on glucose-agar plates abundant, pearly-white colonies, gradually becoming mustard-yellow after five or six days; and (B) which formed smaller, smooth, shiny colonies of a whitish colour, not turning yellow with time. Occasionally a third white organism, distinct from (B), also occurred on the plates.

Inoculations of susceptible canes with the three organisms [details of which are given] showed that the causal organism of red stripe is (B), the other two forms having given consistently negative results, with the exception of a few cases with organism (A) which the authors ascribe to accidental contamination with (B). [See also following abstracts.]

Purdy (Helen A.). **Description of the organism producing bacterial red-stripe disease of Sugar Cane.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 9–17, 4 figs., 1925.

As elicited by the author's pure culture studies [details of which are given], the organism responsible for the red stripe disease of sugar-cane [see last abstract] is a short, motile, non-sporulating, probably Gram-negative rod, with rounded ends, most frequently 1·67 by 0·7 μ in diameter, usually with one, occasionally two or three polar flagella. It occurs usually singly, more rarely in pairs, while occasional chains of not more than six rods were also observed. Its thermal death point is 51° C. in alkaline broth, and 52° in neutral broth. In pure culture the resistance of the organism to desiccation fell well within 24 hours, while 15 minutes' exposure to direct sunlight was sufficient to kill it. According to the descrip-

tive chart of the Society of American Bacteriologists for 1920, the index number of the organism is 5322–32120–1233.

This sugar-cane organism agrees in many of its cultural characters with Miss Elliott's *Bacterium panici* on proso millet [*Panicum miliaceum*] (*Journ. Agric. Res.*, xxvi, pp. 151–159, 1923), and because of the similarity of the lesions caused by the two organisms on their respective hosts the author thinks they should be tentatively considered as identical [but see below, p. 133].

LEE (H. A.), MARTIN (J. P.), & PURDY (HELEN A.). **Diagnostic studies of the organism of red-stripe disease.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 18–24, 1925.

The present study was made with the view to elaborating a rapid method for the identification in culture of the organism causing the red stripe disease of Tip canes [see above abstracts]. The results indicated that the optimum hydrogen-ion concentration for growth of the organism is between P_H 6·6 and 7·0; the growth is inhibited at P_H values lower than 5·4 and higher than 7·3. The behaviour of the organism in the presence of various sugars [details of which are given] shows that a diagnostic test is possible by comparing its growth on monosaccharides and disaccharides in peptone beef-extract agar containing cresol red and brom-cresol purple. In the case of the monosaccharides, strong acid formation turns the medium an intense yellow, and in the case of the disaccharides the medium is turned an intense purple. For this test glucose as a monosaccharide, and sucrose as a disaccharide give the quickest and best results. No great difficulty was encountered in inducing the organism to grow on glucose-agar in Novy jars in the presence of carbon dioxide and absence of oxygen, and also in the presence of hydrogen; for this reason it is considered to be apparently a facultative anaerobe.

MARTIN (J. P.). **The effect of disinfectants on the organism causing red-stripe of Sugar Cane.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 25–32, 1925.

Although disinfectants are not expected to be of practical use for the control of the red stripe disease of sugar-cane [see above abstracts] in the field, their action on the causal organism was studied for general purposes, such as prevention of the spread of the disease into unaffected districts and in quarantine, eradication from the infected areas, and the like.

The experiments were made with pure cultures of the organism in the absence of organic matter, and the results presented in this paper can be considered only as indicating the comparative value of the disinfectants. The action of each disinfectant tested is shown in separate tables, and from the results thus obtained the author considers that the following dilutions may be recommended in practice: phenol 2·5 per cent.; corrosive sublimate 1 in 10,000; lysol 1·5 per cent.; copper sulphate 10 per cent.; formalin 10 per cent.; 0·2 per cent. solution of quicklime; lime-sulphur 1 in 50; uspulun 0·5 per cent.; Dupont fungicide No. 1 (a very finely divided

powder prepared by E. I. du Pont de Nemours & Co., Wilmington, Delaware) 0·2 per cent. For field use, should eradication be found necessary, the use of corrosive sublimate would appear to be the most practical, both because of its high toxicity to the organism, and because of its comparatively low cost.

LEE (H. A.). **Transmission of red-stripe disease by Cane cuttings.** —*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 32–35, 2 figs., 1925.

The results of two sets of experiments showed that transmission of the red stripe disease of sugar-cane [see above abstracts] by cuttings occurred in only one case from a total of 1,000 cuttings from badly diseased canes. An explanation of this somewhat unexpected result with a bacterial disease of this nature is that, as shown by field observations, the infection running down through the stem tissues very rarely passes beyond a few of the topmost nodes. The red stripe organism appears to cause a leaf disease primarily, together with a top rot of the cane in a fairly large percentage of cases, but it does not affect the cane stalk to any extent. Besides, the disease is not one of the vascular system; the organism is found more in the parenchyma and sheath cells than in the phloem or xylem. Transmission of the disease by using infected knives in the preparation of the 'seed' either failed to occur, or occurred in only a very small percentage of cases.

These results lead to the conclusion that, for plantation practice in already infected areas, the expenditure of time on the selection of healthy seed cuttings is hardly warranted, but that as the spread of the disease by cuttings is possible, the adherence to the policy of not exporting cane cuttings from Kohala into healthy districts is still advisable.

BARNUM (C. C.) & MARTIN (J. P.). **The susceptibility of roots, stalks, leaf sheath and leaf blades to red-stripe disease, and the relationship of maturity of tissues to increasing resistance to red stripe.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 35–48, 3 figs., 1925.

Needle-puncture inoculations of pure cultures of the organism responsible for the red stripe disease of sugar-cane [see above abstracts] into various parts of the cane stalk, leaf sheaths, and leaves in different degrees of maturity of susceptible varieties of sugar-cane showed conclusively that the roots of such varieties are easily inoculated with the organism, which was recovered from the resulting red-coloured lesions. The experiments also showed that infection of the roots is possible in nature, as during rains the organism is abundantly washed into the soil from the diseased aerial parts. It was further shown that all the internodes of the canes are susceptible to infection, but that the youngest internodes are the most susceptible; in the latter the ground tissue turns a deep red, the necrotic condition finally resulting in a complete breakdown of the softer interior parts, accompanied by a putrid odour. The older internodes and older canes are much more resistant, the resulting lesions being more or less confined to the rind

of the cane. Although the leaf sheaths are also susceptible, it is not believed that their natural infection is of any great economic importance. The vigorously growing young leaves proved to be the most susceptible parts of the plant and on them wounding was unnecessary; in the experiments their infection was favoured by wrapping them in opaque paper, which excluded light and retained applied moisture. Natural infection of the leaves in the field occurs largely through the stomata, the upper and lower surfaces of the leaves being closely comparable in susceptibility. Plants of a stunted growth were found to be very resistant to the disease.

Barnum (C. C.). **The activities of the red-stripe organism in the soil.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 49–64, 2 figs., 1925.

Experiments carried out both in the laboratory and in the field in the Kohala district of Hawaii [details of which are given] showed that the organism responsible for the red stripe disease of sugar-cane [see above abstracts] is washed in abundance by rains from the diseased leaves of infected canes into the soil, where it may continue to live for periods of at least 32 days, but that during that time a definite reduction occurs in the number of the pathogenic bacteria in the soil. This fact leads to the conclusion that, within this period and in favourable weather, the infection may be carried from one district to another with particles of soil adhering to agricultural implements or the clothes of labourers.

In sterilized soil kept in tubes the organism retained its activity for approximately 40 days, and the reduction of its numbers occurred more slowly, apparently owing to the absence of competition with soil organisms.

Lee (H. A.), Purdy (Helen A.), Barnum (C. C.), & Martin (J. P.). **A comparison of red-stripe disease with bacterial diseases of Sugar Cane and other grasses.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 64–74, 1925.

With a view to ascertain the origin of the red stripe disease of sugar-cane [see above abstracts] in the Kohala district of Hawaii, and in consequence of the failure to find it on the native varieties of cane growing in the small door-yard plantings which are common in Hawaii, a comparison was made with other bacterial diseases of sugar-cane described in literature, a brief review of which is given. None of the species described appears to agree with the causal organism of red stripe; it is pointed out, however, that the causal agents of 'polvillo' [see this *Review*, ii, p. 338] in the Argentine, of a red leaf blemish in Porto Rico described by Earle (*Facts about Sugar*, xvi, 19, p. 383, 1923), and of top rot in Australia [see this *Review*, ii, p. 581] have not yet been determined, so that there still is a remote possibility of their identity with the red stripe organism.

Of the eleven bacterial diseases of grasses other than sugar-cane that are known in literature, nine are reviewed in this paper with the conclusion that they have no connexion whatever with the red stripe disease because of obvious differences in the characters of the

causal organisms. The remaining two diseases, sorghum blight described by Erwin F. Smith and Miss F. Hedges (*Science*, N.S., xxi, 535, p. 502, 1905), and the bacterial stripe disease of proso millet described by Miss Elliott [see above, p. 130], were at first viewed with suspicion because of the similarity of the symptoms to red stripe disease of sugar-cane, but cross-inoculation experiments [details of which are given] repeatedly failed, and this is thought to give reasonable ground for considering them as distinct from the latter.

The authors, therefore, conclude that the causal organism of red stripe disease of sugar-cane is a bacterial species hitherto undescribed, and for convenience in further discussions give it the binomial *Phytomonas rubrilineans* sp. nov. A Latin diagnosis of the organism is appended.

LEE (H. A.) & WELLER (D. M.). **The histology of red-stripe disease.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 75–82, 8 figs., 1925.

A study of microscopical sections of sugar-cane leaves affected with the red stripe disease [see above abstracts] indicated that, under natural conditions in the field, the causal organism chiefly gains entrance to the host tissues through the stomata on the leaves, although where wounds occur infection may take place readily through them. It would also appear that the disease is primarily an infection of the parenchyma cells, but that as the dissemination of the bacteria becomes general in these, they ultimately find their way into the xylem and occasionally into the phloem. The most susceptible tissue appears to be the parenchyma cells rich in chloroplasts which lie just outside the sheath cells surrounding the vascular bundles. The infection of the xylem seems to explain the longitudinal spread of the reddish stripes on the leaves.

In unstained sections of young leaves the most striking feature is a change of the chloroplasts from the normal green to a brownish-red colour, which accounts for the red coloration of the stripes. The affected chloroplasts are not disintegrated at first, but in older lesions they are broken up, and sometimes all trace of them disappears. In older lesions also the xylem cells are often filled with a dark, opaque, gummy substance. A lysis was observed of the walls of the parenchyma cells, which the authors believe to be caused by the action of the metabolic by-products of the organism, rather than by the physical action of the bacteria. The lytic action on the walls would appear to start in the middle lamellae, and to proceed until the wall is so weakened that it collapses. There is no tearing or splitting of the tissues as in some other bacterial diseases of plants, and neither hyperplasia nor hypertrophy was observed. In new lesions the bacteria occur only between the cells, but later on, as the tissues begin to break down, they penetrate into the xylem and apparently also into the parenchyma cells.

LEE (H. A.) & BARNUM (C. C.). **Cane varieties resistant to bacterial red-stripe disease.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 83–93, 1925.

Details are given of artificial inoculation experiments with pure

cultures of the organism responsible for the red stripe disease of sugar-cane [see above abstracts] on a number of promising Kohala seedlings selected by agriculturists, in order to test them for relative resistance to the disease. The results of these experiments, which agree very closely with those of field tests, in which the seedling varieties tested were interplanted with alternating rows of heavily infected Tip canes, indicate that D 1135, Badila, Yellow Caledonia, and H 109 are commercially resistant, as well as K 117, K 107, K 115, and K 73 (all four of D 1135 pistillate parentage). Manoa 198 (a seedling of Yellow Tip) and K 382 (a seedling of H 146) have indications of commercial resistance.

Results of variety tests to compare the sugar production of the above seedlings with the Tip canes are not yet available.

LEE (H. A.), BARNUM (C. C.), & JENNINGS (W. C.). **Methods of combating red-stripe disease.**—*Red-stripe Disease Studies*, pamphlet of the *Exper. Stat. Hawaiian Sugar Planters' Assoc.*, pp. 93–99, 1925.

Although the red stripe disease of sugar-cane [see above abstracts] is for the present confined to the Kohala district of the island of Hawaii, where it affects almost exclusively the Tip varieties and even on these is responsible for but small financial loss, varying from less than 1 to 10 per cent. of the crop, there is a definite danger of its spreading, through insect, bird, or human agency, to the Hamakua and Hilo districts of the same island, where the damage caused by it would probably be much more considerable, owing to weather conditions there being more favourable for the disease than in Kohala. Strict sanitary precautions are therefore advocated to minimize this danger, consisting of an adequate disinfection of all agricultural implements, rolling stock, and also of all articles of clothing of the persons engaged in work in infected fields, besides the prohibition of the transportation of cane cuttings from Kohala as provided by the existing quarantine regulations [see this *Review*, iii, p. 683].

Agricultural practices may aid in keeping down the disease in Kohala. Red stripe is primarily a disease of young cane, and is also a wet weather disease. It has been shown in practice that early planting and early application of fertilizers can force the cane to a height of three or more feet before the winter rains, and thus the danger of infection can be minimized. The use of resistant varieties is recommended as the most satisfactory method for the control of the disease.

HANSFORD (C. G.). **Mosaic disease of Sugar-cane.**—*Proc. Ninth West Indian Agric. Conf., 1924*, pp. 76–82, 1925.

This paper contains an account of the mosaic disease of sugar-cane and discusses its control. Special reference is made to the probable sources of infection, both aerially, by means of *Aphis maidis*, and in the diseased tops used for planting, and the danger from susceptible grasses and maize growing in proximity to the cane is emphasized. The author reviews the spread of the disease in Java and in the West Indies, and describes the survey carried out in Jamaica after its first discovery there in 1920.

In discussing the control of the disease, the introduction of tolerant varieties to replace the older susceptible kinds is thought to have serious disadvantages, since these varieties may become infected to the extent of 100 per cent. and still yield well, while any new and superior variety, not equally tolerant, would rapidly become infected from them and be killed out.

Where there is more than 15 per cent. infection, roguing is impracticable and the cultivation of the immune Uba variety should be undertaken. Later on this variety can be replaced by healthy tops of superior canes from a special nursery.

In the discussion (p. 82) Professor Ashby gave some particulars of the occurrence of mosaic disease in the Leeward Islands, where it was first reported early in 1923 in Antigua, St. Kitts, and Nevis. It was apparently introduced into St. Kitts from the neighbouring American Virgin Islands about 1919, and is confined to the St. Croix seedling. Spread is exceedingly slow, as it seems to be only propagated by diseased cuttings from the one variety and complete eradication seems, therefore, to be practicable. In Antigua and Nevis other varieties are affected and the spread is more rapid.

As regards the immunity of the Uba cane from mosaic, it is pointed out that this variety may not be really immune, but may merely be tolerant, as the Java seedling G. Z. 100 P.O.J. appears to be.

ASHBY (S. F.). **Three serious Cane diseases not yet reported from the British West Indies.**—*Proc. Ninth West Indian Agric. Conf., 1924*, pp. 84–89, 1925.

An account is given in this paper of gumming (*Bacterium vascularum*), Fiji disease or leaf gall (*Phytamoeba sacchari*) [*Northiella sacchari*], and stripe disease (*Sclerospora sacchari*) of sugar-cane [see this *Review*, ii, p. 579]. Only the first of these has been observed in the West Indies, having been found over a considerable area in Porto Rico.

PETCH (T.). **Additions to Ceylon fungi, III.**—*Ann. Roy. Bot. Gard., Peradeniya*, ix, 3, pp. 313–328, 1925.

In this paper critical notes are given of 95 additional Ceylon fungi chiefly Hymenomycetes, Pyrenomycetes, Discomycetes, and Deuteromycetes. English diagnoses are given of the 57 new species included. Amongst the more interesting parasitic forms the following may be mentioned.

Three new parasitic species of *Corticium* are described. The first, *C. pervagum*, is found on *Erythroxylon coca* and is distinguished by the stout, regular, septate, hyaline hyphae, 4 to 6 μ in diameter, which overrun the leaves and twigs. The hymenium forms diffuse, white, powdery patches on the leaves. The basidia are solitary or in groups on the basal hyphae, or lateral and terminal on short erect branches, sessile, pyriform, often septate, measuring 16 by 8 μ; sterigmata tapering, 8 μ long; spores hyaline, ellipsoidal but somewhat inequilateral, and 5 to 8 by 3 to 5 μ.

C. invisum causes the black rot of tea in Ceylon [see this *Review*, iii, pp. 4, 384; also in India, see next abstract], occurring also on *Hemidesmus indicus*, *Calophyllum burmanni*, *Vernonia scariosa*,

and *Oxyanthus tubiflorus*. The mycelial film resembles that of the last species, but the hymenium is at first reticulated. The basidia are either subglobose and 8 to 9 μ in diameter, or ovoid and 9 by 7 μ; sterigmata stout, attenuated above, up to 6 μ long, 1·5 μ in diameter; spores ellipsoidal, adherent, hyaline, and 5 to 6 by 3 to 4 μ.

The third species, *C. penicillatum*, the cause of coco-nut thread blight in New Guinea, has been already noticed [see this *Review*, iv, p. 278].

Mycosphaerella citrullina (C. O. Sm.) Gros. is recorded on *Luffa acutangula*; *M. caricae* Syd. on papaw; *M. camelliae* n. sp. associated with *Phyllosticta theae* Spesch., on tea; *P. theobromae* d'Alm. & Cam, on cacao; *P. carica-papayae* Allesch. on the papaw; *Phomopsis theae* n. sp. and *Ascochyta theae* Hara. on tea; *A. rosicola* Sacc. on cultivated roses; *Hendersonina sacchari* Butl. on sugar-cane; *Septoria lycopersici* Speg. on tomato; *Colletotrichum ricini* n. sp. on stems of *Ricinus communis*; *Pestalozzia theobromae* n. sp. on cacao; *P. piperis* n. sp. on *Piper nigrum*, and *Acrothecium lunatum* Wakker on sorghum.

TUNSTALL (A. C.). **Some notes on Tea diseases caused by Corticium spp.**—*Quart. Journ. Indian Tea Assoc., 1925*, 2, pp. 53–59, 4 pl., 1925.

During the last few seasons diseases of tea caused by species of *Corticium*, of which at least five occur, have been increasingly prevalent in north-east India. The commonest form is the 'black rot', which was originally considered to be due to *C. theae*, but has since been found to resemble more closely *C. invisum*, described from Ceylon [see preceding abstract]. The disease causes irregular, brown patches on the leaves, which do not fall, but remain attached to the stems or to each other by a small cushion of fungus mycelium. Occasionally they may be found hanging by a tiny thread. In wet weather the young leaves become rotten and slimy, and the older ones black. The fructifications arise as powdery, white patches on the under side of apparently healthy leaves. The spores are obovoid, slightly curved on one side near the base, and borne on short sterigmata arising from short, club-shaped basidia. Spores collected in July 1919 averaged 10·9 by 6·2 μ, whilst others collected in June 1925 averaged 7·6 by 5 μ. The loss occasioned by the disease is not readily apparent on healthy tea bushes, but in time they deteriorate considerably. Treatment with lime-sulphur has been applied repeatedly with marked success. Infected areas should be isolated and sprayed as soon as possible, starting on the healthy tea round the edges. The disease spreads with rapidity, and if the attack becomes general it is impossible to carry out the treatment until after the bushes have been pruned.

A new disease, which has appeared during the last two years in the gardens bordering the Himalayas, is caused by another species of *Corticium*, designated *C.* sp. 1, but not named. The fungus attacks and bleaches the brown bark of the young wood. It usually starts at forks on the young woody stems and spreads until the whole of the brown bark is bleached, but it has not yet been found on the green shoots. The fructifications occur in white or pinkish patches,

$\frac{1}{8}$ to $\frac{1}{4}$ inch across, usually produced below forks on the young twigs. The spores are oblong, colourless, and average 10·1 by 5·3 μ. They are borne on long club-shaped basidia, with two to four sterigmata. The fungus causes little immediate damage on vigorous tea bushes, but on badly nourished plants it produces serious injury. The treatment which has proved effective against this disease at Tocklai is to spray with lime-sulphur after pruning. The prunings should be burnt, and, in addition, measures taken to improve the health of the bushes. Special attention to cultivation and pruning, without spraying, resulted in one instance in a considerable reduction of the disease.

Another species of *Corticium*, distinguished as *C.* No. 2, was found forming white patches on dead twigs, where it appeared to be purely saprophytic. A species which is probably *C. salmonicolor* [see this *Review*, iv, p. 509; v, p. 7] causes the death of patches of bark and the production of cankerous growths. Specimens bearing mycelium resembling *C. theae* have also been observed from time to time, but so far fructifications have not been obtained.

SHAW (W. S.). **Black rot disease of Tea.**—*Planters' Chron.*, xx, 43, pp. 788–791, 1925.

This paper contains a general account of the black rot disease of tea in India which is attributed to *Corticium invisum* and also to some extent to *C. theae* [see preceding abstract].

The treatment recommended against both fungi is to collect and burn the prunings of infected and neighbouring bushes, and then to spray with lime-sulphur. The small patches showing the least infection should be sprayed first and the larger areas as time permits. The treatment should be repeated after an interval of about a week. The preparation of the stock solution of lime-sulphur from quick-lime 20 lb., sulphur $22\frac{1}{2}$ lb., and water 50 galls. is described, and for use it is recommended that this solution be diluted to 1 in 7. The Four Oaks Pneumatic Knapsack Sprayer has given the most satisfactory results in applying it.

HOFFMANN. **Krankheiten am Tabak.** [Diseases of Tobacco.]—*Prakt. Blätter für Pflanzenbau und Pflanzenschutz,* iii, 7, pp. 153–155, 1925.

Tobacco in the Pfalz district of Bavaria was affected in 1925, as usual, with what the growers call 'rust', a term applied to any diseased appearance of the leaves. Practically every year the leaves show small white or brownish spots, which do relatively little harm. Many plants, however, bear more or less deformed leaves on which are large brown spots, usually accompanied by grey or brown streaks on the petioles and stem. Later on the leaves of these plants rot and fall over on the stem, the latter also becoming decayed. In the hollow pith of the stem and midribs, sclerotia of the fungus *Sclerotina sclerotiorum* are found. Infection experiments with this fungus have proved successful at Munich, but only on the weaker of the two plants inoculated. This disease was less severe in 1925 in the region of the Pfalz district in which cigar tobacco is grown than elsewhere, and it was frequently observed that plants badly handled during transplanting (for

instance those in which the tap root was bent) were most injured. In the recent attack it appeared as if infection occurred at the upper part of the plant, perhaps at the wound left in topping, but previously it has been held to progress from the base upwards. For the control of the disease, which caused losses up to 25 per cent. of the crop in some fields, search should be made for resistant varieties, while good cultural methods, directed to secure strong plants, are essential. Diseased plants should be removed and destroyed.

In the cigar tobacco-growing area of the Pfalz a second disease was much more prevalent than the last. This was attributed in 1924 to the attack of a *Phytophthora* or *Peronospora* [see this *Review*, iii, p. 613], but scientific investigation at Munich has failed to disclose the presence of any such fungus. The leaves of affected plants become covered with spots having a light coloured margin and a dark centre, which are scattered throughout the crop and resemble the result of hail. These spots may be very numerous and may run together, so that the whole leaf becomes discoloured as if scorched. All varieties with wavy leaves appear to be more susceptible to this disease than those with a smooth surface. No difference was observed in the intensity of the attack on strong or weak plants, but spread seemed to be more marked at certain periods of the year. Though the cause of this disease is unknown, spraying with Bordeaux mixture, as against vine diseases, has given good control.

JOHNSON (J.) & MURWIN (H. F.). **Experiments on the control of wildfire of Tobacco.**—*Wisconsin Agric. Exper. Stat. Res. Bull.*, 62, pp. 1–35, 7 pl., 1925.

Observations made by the authors in Wisconsin over a period of three years show that in nearly every case the infection of tobacco in the field by wildfire (*Bacterium tabacum*) can be traced to seed-bed infection. The basis of control measures, therefore, is the elimination from the seed-beds of all materials likely to carry the disease.

The wildfire organism overwinters most readily in the dry and dormant condition. Infected tobacco leaves which are cured or dried and remain dry between the growing crops are one source of infection; another is believed to be infected tobacco trash, which may accidentally reach the seedlings in a number of ways. The seed-beds, therefore should be situated as far as possible from the curing sheds, and frames or covering which have been stored therein should be thoroughly cleaned and disinfected before use.

On the seed, the organism can live in the dormant stage for as long as two years. Seed, however, is not believed to be a common source of infection, although it should not be sown unless adequately disinfected. Tests of various seed disinfectants showed that a solution of silver nitrate (1–1000) gave the best results, complete control being obtained by two 5- or 10-minute treatments, the seed being dried between each treatment. Corrosive sublimate was not so efficacious and cannot be used where seed is to be sprouted before sowing.

The bacteria do not appear to overwinter in moist soil, and the

authors consider that there is probably no danger in using land for tobacco which has previously grown infected crops, especially if the refuse and stubble from the preceding crop are thoroughly ploughed under.

Once the disease manifests itself in the seed-bed, very little can be done to reduce the amount of infection if the weather conditions are favourable. Dusting and spraying with copper-lime dust and Bordeaux mixture, respectively, gave only partial control. Infected plants and those near them should be destroyed and may, without danger, be dug into the soil.

Great care should be taken not to transplant diseased seedlings, as this may result in extremely heavy field infection, no satisfactory method of preventing which has been discovered. Spread is believed to be almost entirely dependent upon rainfall, especially when accompanied by strong winds.

It was found that the organism often loses its virulence in a relatively short time. Many factors appear to be concerned in this, including the nature of the culture medium, the frequency of transfer, and 'strain' differences in the organism.

The wildfire bacterium produces a toxin in the host tissues and in culture, which is responsible for the chlorosis of the plants. This toxin is readily separable from the bacteria by filtration, and will, by itself, produce typical symptoms when inoculated.

It is believed that the methods of control outlined would be equally effective against blackfire [*Bact. angulatum*].

To control blue mould of Tobacco.—*Agric. Gaz. New South Wales*, xxxvi, 9, p. 624, 1925.

The control of blue mould of tobacco (*Peronospora* sp.), which makes its appearance in New South Wales particularly in seasons of heavy rainfall, should be directed towards preventing conditions favourable to the disease. A number of seed-beds, suitably manured, should be prepared and sown at intervals of two or three weeks. The young plants should be allowed plenty of air and sunlight, and should be transplanted at the earliest opportunity. If the disease appears in any one bed, the infected plants should be destroyed immediately and the remainder sprayed with Bordeaux mixture (2–2–50).

Cook (M. T.). **'El salcocho' en los semilleros de Tabaco.** ['El salcocho' in the Tobacco seed-beds.]—*Rev. Agric. Puerto Rico*, xv, 4, pp. 187–188, 1925.

The tobacco disease known in Porto Rico as 'el salcocho negro' is stated to be probably caused by *Phytophthora nicotianae* and to have caused considerable damage to tobacco seedlings in the island. It is marked by the development of large, black, water soaked areas on the leaves and stems, which spread rapidly and finally destroy the plants. The minute spores of the fungus readily adhere to implements, and may have been thus transmitted to healthy areas.

Directions are given for the preparation and use of Bordeaux mixture for the control of this and other diseases of tobacco seed-beds.

WALKER (M. N.). **Studies on the mosaic disease of Nicotiana glutinosa.**—*Phytopath.*, xv, 9, pp. 543–547, 1 pl., 1925.

Allard in 1916 [*Journ. Agric. Res.*, vii, pp. 481–486] described a mosaic disease on *Nicotiana glutinosa* (the name *N. viscosum* is stated to have been used in error) which was said to be distinct from that on tobacco. In view of the recent work on the common causal agency of many of the mosaic diseases, the present author has tested this statement by means of cross-inoculation experiments, using crushed tissues as the inoculum. It was found that the mosaic disease of tobacco is transmissible to *N. glutinosa* and that of *N. glutinosa* to tobacco and to tomato. Mosaic of ground-cherry (*Physalis pubescens*) was also transmitted to *N. glutinosa*.

During midwinter, symptoms of mosaic failed to develop on inoculated plants of *N. glutinosa*, although some of the plants showed the symptoms some weeks later, a phenomenon probably due to a condition of the host plant which prevented the manifestation of decided and recognizable symptoms. It is thought that Allard's results are capable of a similar explanation.

WILSON (M.). **Studies in the pathology of young trees and seedlings. I. The Rosellinia disease of the Spruce.**—*Trans. Roy. Scot. Arbor. Soc.*, xxxvi, 2, pp. 226–235, 4 pl., 1922.

A serious outbreak of the disease which forms the subject of this paper was investigated over fifteen years ago by Borthwick, to whose notes the author has had access. It occurred on 2-year-old plants of *Picea excelsa* in a nursery in the south of Scotland, practically all the plants in which were attacked. The affected plants were covered at the base of the stem and upper part of the root with a grey mycelium of fairly regular hyphae, with few pear-shaped swellings and 2 to 8 μ in diameter. These were frequently united into strands. Some of the hyphae were branched to form definite conidiophores and bore at their tips oval, hyaline conidia, 8 by 4 μ in diameter. The mycelium penetrated the cells of the cortex and reached as far as the cambium.

Perithecia belonging to the genus *Rosellinia* developed on plants placed in a moist chamber, at first singly and then in masses forming an almost continuous layer. They were black, round, with a small projecting ostiole and 0·7 to 1 mm. in diameter. The asci were paraphysate, 120 to 140 by 8 μ in the sporiferous part, and bore 8 dark brown, navicular spores, 18 to 20 by 7 to 8 μ. The flat side is traversed by a fine line, marking a thickening of the spore wall.

The only *Rosellinia* known to attack the spruce is said to be *R. necatrix*, from which the present form is distinct. Its differences from *R. quercina*, to which it bears a rather close resemblance, are also discussed. *R. aquila* has already been reported on the spruce (but up to now only on mature wood which is apparently not injured) and the author assigns his fungus to this species with some hesitation.

For the control of the disease the affected plants were eradicated and the seed-beds soaked with copper sulphate, with the result that further extension was checked. In mild attacks, or where the number of diseased plants is small, trenching and the sterilization,

by burning or the use of carbolic acid or copper sulphate, of the soil within the trench are recommended.

HEDGCOCK (G. G.), GRAVATT (G. F.), & MARSHALL (R. P.). **Polyporus schweinitzii Fr. on Douglas Fir in the eastern United States.** —*Phytopath.*, xv, 9, pp. 568–569, 1925.

In a small plantation of Douglas fir, near Biltmore, North Carolina, planted in 1896 with trees from Scotland, *Polyporus schweinitzii* was found causing a red-brown butt and root rot. At the base of wind-thrown trees fructifications of the fungus developed. This fungus has never been reported as seriously injuring young Douglas fir trees in the north-western States, although it is very destructive to older ones in that region. It is considered possible that introduced species may be rendered more susceptible to root rots by a change of habitat and, in the present instance, the fungus (which occurs in the eastern United States) probably spread from neighbouring hosts to the imported firs.

DUFRÉNOY (J.). **La maladie de l'encre du Châtaignier.** [The ink disease of Chestnut.]—Reprinted from *Ann. Off. Agric. Rég. du Sud-Ouest, Bordeaux*, fasc. x, 20 pp., 18 figs., 1925.

This is a brief and popular account of the ink disease of chestnuts (*Blepharospora cambivora*), most of the information contained in which has already been noticed from another source [see this *Review*, iv, p. 577]. The main point of interest is the statement that since 1882, when the disease devastated the chestnut plantations in the region of Sare, it has now spread practically over the whole of south-western France, from the Pyrenees in the south to Médoc in the north, where it is now attacking isolated trees. In that region, as elsewhere, the spread of the disease around a new centre of infection is rapid during the first two or three years, but soon slows down, chiefly owing, in the author's belief, to the competition of saprophytic organisms with the causal fungus.

Succinct details are given of artificial inoculations of native chestnut seedlings with pure cultures of the fungus, in which the progress of the infection was sometimes so rapid as to kill the seedlings within three weeks from inoculation. From the roots of such seedlings the organism was easily recovered. In another experiment, where chestnuts were sown in the unsterilized soil from under a plantation of trees that had been killed by the disease, 60 per cent. of the resulting seedlings were killed in six weeks, and by the end of the same summer only 10 per cent. were still alive.

SCHREINER (E. J.). **Preliminary survey of Hypoxylon Poplar canker in Oxford County, Maine.**—*Mycologia*, xvii, 5, pp. 218–220, 1925.

Data are recorded in this paper concerning the incidence of *Hypoxylon pruinatum* [see this *Review*, iii, p. 615] on the aspen (*Populus tremuloides*) in Oxford County, Maine.

In the same area, trees growing in the open showed about 21 per cent. infection whilst older ones in the forest stand were somewhat

less infected. This result may possibly be due either to the effect of age on susceptibility or to spore dispersal factors.

In the open the cankers were found near the base of the tree and in the forest for the most part in the upper part of the tree.

P. tacamahacca was not attacked even when in proximity to infected trees, and appears to be immune from the disease.

SCHANTZ (K.). **Das Interesse der deutschen Wirtschaft an der Holzkonservierung.** [The interest of German industry in timber preservation.]—*Elektrotechn. Zeitschr.*, xlvi, 29, pp. 1067–1071, 1925.

The importance of wood preservation in maintaining an efficient electrical service is emphasized and the financial, industrial, and technical problems in connexion with the establishment of an industrial laboratory for research on the value and application of the various preservatives are discussed at some length.

KÖNIG. **Das Beizen der Samen mit Tillantin B.** [Seed disinfection with Tillantin B.]—*Deutsche Obst- u. Gemüsebauzeit.*, lxxi, 37, p. 538, 4 figs., 1925.

Excellent results in the control of fungous diseases and the production of increased yields are said to have been obtained in 1923 by treatment of various vegetable seeds with 0·2 per cent. tillantin B for periods of 30 minutes to five hours. The effects of this preparation are stated to be particularly noticeable on old seed; that used in the tests was two to four years old.

DOOLITTLE (S. P.) & WALKER (M. N.). **Further studies on the overwintering and dissemination of Cucurbit mosaic.**—*Journ. Agric. Res.*, xxxi, 1, pp. 1–58, 6 pl., 1 diag., 1925.

The results of further experiments made at Madison, Wisconsin, in 1919 and 1920 have confirmed the conclusion reached from earlier investigations (see *U.S. Dept. of Agric. Bull.* 879, 1920) that the cucurbit mosaic does not overwinter in the soil. Additional work on the seed transmission of the disease has been carried out, but when added to the previous trials the results gave only one case of apparent transmission by the seed in approximately 22,000 plants grown from mosaic cucumber seed and none in the less extensive trials with muskmelon, squash, and pumpkin.

The seed of certain wild hosts proved, however, to be an important agency in the overwintering of the disease [see this *Review*, ii, p. 512]. The wild cucumber (*Micrampelis lobata*) is able to transmit cucurbit mosaic through the seed, and the disease is transferred to the cultivated forms by the cucumber aphis (*Aphis gossypii*), the 12-spotted beetle (*Diabrotica duodecimpunctata*), and particularly the striped beetle (*D. vittata*) which feeds first on the wild host and then migrates to the cultivated cucumbers, the disease being carried as much as 400 yards in this way. In Wisconsin and northern Illinois, field surveys have indicated that there is a distinct correlation between the number of groups of mosaic plants of the wild cucumber and the extent of the disease in the fields.

The milkweed (*Asclepias syriaca*) is also susceptible to cucumber mosaic. The virus persists in the roots of the milkweed and the

cucumber aphis acts as a carrier of the disease from this host to the cucumber. Observations indicate that the milkweed is originally infected from adjacent cucumbers. It appears to be of more importance than the wild cucumber as a source of infection to the cultivated cucurbits in many localities, as mosaic milkweeds, although comparatively rare, usually occur in the vicinity of the fields.

The pokeweed (*Phytolacca decandra*) also harbours the cucurbit mosaic in its roots during the winter, and the cucumber aphis carries the disease from it to the cucurbits. The pokeweed is rare in Wisconsin and northern Illinois, but is common in southern Indiana and southern Illinois, where it seems to be an important source of infection.

Cucumber mosaic also overwinters in the roots of catnip (*Nepeta cataria*) and certain perennial species of *Physalis*. All species of Cucurbitaceae tested have proved susceptible, except those of the genus *Citrullus*, infection having been produced in 11 genera, including 23 species.

There is no evidence of seed transmission of mosaic in the case of *Martynia louisiana*, pepper (*Capsicum annuum*), or pigweed (*Amaranthus retroflexus*) [loc. cit.], and as these hosts are annuals they are not concerned in the overwintering of the mosaic, although they act as sources of infection during the summer.

ROLDAN (E. F.). **Notes on soft rot of Radish.**—*Philipp. Agric.*, xiv, 3, pp. 185–188, 1 pl., 1925.

Forty per cent. of the radishes (*Raphanus sativus*) in an experimental plot at the Los Baños College of Agriculture (Philippine Islands) were observed to be affected by a wilting of the foliage, accompanied, in advanced stages, by a bacterial rotting of the underground portions. Sections through the latter showed water soaked, brownish lesions, sometimes associated with black streaking or discoloration and bacterial exudation.

The causal organism was identified as *Bacillus carotovorus*, the morphological, cultural, and physiological characters of which are described.

Positive results were obtained in inoculation tests with pure cultures of the organism on radish, leaf-mustard (*Brassica juncea*), lettuce, pechay (*B. sinensis*), tomato fruits, and chilli pepper (*Capsicum annuum*).

Control measures should be based on crop rotation; thorough desiccation of root surfaces before storage; exposure of harvested roots to sunlight for as long as possible; and low temperatures (above freezing-point) in the storage room.

MAUBLANC (A.). **La maladie des taches brunes de l'Arachide en Afrique occidentale.** [The leaf spot disease of the Groundnut in West Africa.]—*Agron. Colon.*, xiii, 93, pp. 126–127, 1925.

The occurrence of the leaf spot disease of the groundnut [*Arachis hypogaea*], caused by the fungus *Cercospora personata*, has only recently been notified for the first time in Senegal, though it is thought probable that it has been in the country without attracting attention previously. The heavy rainfall in August and September,

1924, probably favoured its spread. Only in certain localities was severe damage caused (up to 15 per cent.). The importance of selecting resistant varieties is emphasized.

Van Overeem (C.). **Cercosporaceae. Cercospora cassavae Ell. & Ev.**—*Icones Fungorum Malayensium*, x, 4 pp., 1 col. pl., Vienna, 1925.

According to the author, the three species of *Cercospora* recorded on cassava [*Manihot utilissima*] are the same; they are *C. cassavae* Ell. & Ev. (the oldest, and therefore correct name), *C. manihotis* Henn., and *C. henningsii* Allesch. He states that confusion originally arose because Ellis & Everhart cited the name of the host as '*Cassava*', and this was incorporated in Saccardo's Sylloge as the correct Latin generic name.

The disease caused by this fungus is said to be common in all tropical regions where cassava is grown.

In a brief discussion on the systematic position of the fungus, it is recommended that the genus *Cercosporella* be deleted, as it only differs from *Cercospora* in the absence of pigment and all degrees of transition between the two genera occur.

[No reference is made to *Septogloeum manihotis* Zimmermann, a name under which what appears to be the same fungus is widely known in Africa and India. This is, no doubt, a further synonym for *C. cassavae*.]

Wilson (J.). **Vine mildew.**—*Gard. Chron.*, lxxviii, 2031, p. 432, 1925.

Observations made at Wisley indicate that the vine mildew [*Uncinula necator*] ordinarily appears about 10 days before flowering time in May on the vines grown under glass.

Satisfactory control has been obtained with sulphur applied 10 days or a fortnight before the mildew usually appears, and continued at weekly intervals until the flowers open. Applications are then suspended until the berries set, and the final dusting is given when the latter are about the size of peas. Experience has shown that this treatment is more effective than the postponement of sulphuring until mildew first appears.

Ravaz (L.). **Chronique.—Traitement d'hiver de l'Oïdium.** [Current events.—Winter control of *Oidium*.]—*Prog. Agric. et Vitic.*, lxxxiv, 48, pp. 509–510, 1925.

The winter control measures against *Oidium* [*Uncinula necator*] of the vine recommended in this brief note, written in the form of a reply to an inquiry from Oran [Algeria], consist of a somewhat earlier pruning (before the shedding of the leaves) of the vines when the perithecial stage of the fungus is abundant, of the removal and destruction by fire of all the leaves and prunings, and of washing the dormant vines with an acid iron sulphate solution (iron sulphate 35 kgm., sulphuric acid 3 kgm., water 100 l.). The latter measure was shown about twenty years ago to lack efficacy somewhat, when perithecia occurred in large numbers on the vines, but it is still recommended, as it protects also against chlorosis and is considered, in regard to the latter, to be as efficacious as 500 gm.

of sulphate of iron applied at the foot of the vine stock. These measures are but palliatives, the disease being amenable only to sulphur dustings during the growing period of the vine. The first dusting should be made when the young shoots are from 15 to 20 cm. long, hand shakers being preferable to the bellows now generally in use, as the latter do not discharge the sulphur in sufficient abundance.

RAVAZ (L.). **Sur l'excoriose.** [On excoriosis.]—*Prog. Agric. et Vitic.*, lxxxiv, 42, pp. 370–372, 1925.

From information supplied by Croizau, a vine grower in Morocco, it appears that the Aramon grapes in that country suffer from a form of excoriosis [see this *Review*, iv, p. 524] at the ripening period, which has reappeared annually for the last six years. A black band develops around the stalks of the bunches and causes the grapes to shrivel. This condition, however, is limited to certain vines and shows no signs of spreading. The actual cause of the disease has not been determined, but a damp soil is evidently essential to its development. Spraying has had no effect on its control.

Observations made in France indicate that other varieties are also susceptible to this disease, the blackening being sometimes apparent as a patch in the centre of the bunch stalk, instead of forming a ring at the base. The condition is most frequent at the base of the fully matured shoots. Fructifications of *Phoma* [*flaccida*] were found on the diseased bunch stalks.

It is evident that this disease attacks not only the woody parts of the vine, especially causing the shoots on the two-year-old wood to break off, but also injures the bunches, causing the grapes to dry up.

RAVAZ (L.). **Flavescence et rougeau.** [Flavescence and rougeau.]—*Prog. Agric. et Vitic.*, lxxxiv, 46, pp. 461–463, 1925.

A diseased condition of the vine confined entirely to the 'Pinot blanc' variety has been reported recently in Jugo-Slavia and is stated by the author to correspond closely with the characteristic 'flavescence' frequently seen in France on several white grape varieties. The leaves are folded or bent downwards, stretching the upper surface which becomes glossy and smooth, while the maturation of the branches is checked. This latter effect is equally characteristic of the condition known as 'rougeau', which is common amongst the red grape varieties following drought [see this *Review*, iv, p. 143].

Both flavescence and rougeau are dependent on soil conditions which prevent the vine from consuming the food material assimilated by the foliage. They may be, to a large extent, avoided by improved cultivation methods, especially better drainage and aeration of the soil.

RAVAZ (L.) & VERGE (G.). **Sur l'influence des éléments fertilisants sur la santé de la Vigne.** [On the effect of fertilizers on the health of the Vine.]—*Ann. École Nat. d'Agric., Montpellier*, N.S., xviii, 4, pp. 237–244, 1 col. pl., 1925.

The authors discuss the influence of the soil and fertilizers on the

development of 'brunissure' of the vine, a condition which is distinguished from 'rougeau' [see last abstract] by the brown blotches, which subsequently darken to a chocolate colour, on the upper surface of the leaf.

Observations made at the Montpellier School of Agriculture on Aramon vines grafted on Riparia stocks on a calcareous clay soil, show that the condition depends on the proportion of potassium to lime available for the vines. The plots receiving no fertilizer or only superphosphate of lime were markedly affected, while those to which sylvinite (a potassium fertilizer), or the same plus 1 kg. of superphosphates, had been applied, remained still green.

SMOLAK (J.). **Zpráva o činnosti stanice pro choroby rostlin při st. vyšši škole ovocnicko-vinařské a zahradnické na Mělníce za rok 1923 a 1924.** [Report on the activity of the Phytopathological Station at the High School of Pomiculture, Viticulture and Horticulture at Mělnik, for the years 1923 and 1924.]—*Ochrana Rostlin*, v, 3, pp. 41–46, 1 fig., 1 map, 1925.

The Phytopathological Station at Mělnik [Czecho-Slovakia] was created in 1923, and is intended to deal more particularly with diseases of fruit trees, the vine, and ornamental plants. Its functions include imparting free information and advice to the local growers, propaganda work, the collection of statistical data on the diseases prevalent in the region, and experiments with insecticides, fungicides, and the like, submitted to it for testing.

In the two years of its existence, the Station has established the occurrence in the region of the following diseases. Bacterial tumours (*Pseudomonas* [*Bacterium*] *tumefaciens*) on the roots of fruit trees (considerably more widespread than formerly believed), and also on the roots of *Chrysanthemum latifolium* f. 'Beauté nivelloise' in greenhouses, and of raspberry. *Nectria* [*galligena*] cankers on the branches on fruit trees are very common, chiefly because the pruning and spraying of the trees are neglected by the growers. Asters suffer from attacks of a species of *Fusarium*, *Phytophthora omnivora*, and a *Pythium*. *Heterosporium gracile* is widespread on iris and *Botrytis canescens* occurs on white lilies. *Gloeosporium ribis* is now established all over the region and causes considerable damage to currant plantations, while the American gooseberry mildew [*Sphaerotheca mors-uvae*] is gradually losing ground. Among ornamental trees, lime trees suffer heavily from attacks of *Gloeosporium tiliae*, and birches from *Melampsoridium betulinum*. In the forests, the pines are attacked by *Nectria cucurbitula*, and the firs by *Apiosporium pinophilum*.

EASTHAM (J. W.). **Report of Provincial Plant Pathologist, Vancouver.**—*Nineteenth Ann. Rept. Dept. of Agric. Brit. Columbia for the year 1924*, pp. K32–K34, 1925.

Owing to the unusually dry summer of 1924 in British Columbia, the incidence of apple scab [*Venturia inaequalis*] in the Kootenays was negligible, except for a slight outbreak on susceptible varieties in September, after the late summer rains. Such late infections are stated to be uncommon. The results of experimental work indicated that a spray later than two or three weeks after the

calyx application would not be worth while, except about once in five years.

Drought spot and corky core of apples were very prevalent and severe, especially on the McIntosh variety. Drought and unfavourable soil or root conditions are believed to be involved in the causation of these disturbances.

Mushroom root rot (*Armillaria mellea* caused heavy damage to apple, plum, cherry, and pear trees in an orchard at Shaughnessy Heights.

Blossom blight of Olivet cherries, believed to be due to *Monilia oregonensis* [*Sclerotinia cinerea*; see this *Review*, iv, p. 487; v, p. 108] caused severe losses in the Victoria district, and the spraying programme recommended for Oregon did not prove very successful.

Several cases of black knot of plums and cherries (*Plowrightia morbosa*) [*Dibotryon morbosum*] were reported from Lulu Island.

Powdery mildew of red clover (*Erysiphe* sp.) was extremely prominent, some fields being covered with the greyish-white mildew. The perithecial stage was not observed.

On Lulu Island Burbank potatoes were affected by net necrosis [see this *Review*, iii, p. 508]. A form of spindling sprout [see this *Review*, iii, p. 415], which has recently been reported to affect 50 per cent. of the potato crop in the State of Washington, has also been observed.

GADD (C. H.). **Report of the Division of Botany and Mycology.**— *Ceylon Administration Reports for 1924*, pp. D13–D14, 1925.

Besides matters already noticed in this *Review* the following references are of interest.

Fomes lucidus, which is suspected to cause a root disease of *Hevea* rubber, has been isolated and grown in pure culture but inoculations on two *Hevea* trees have resulted in no ill effects.

Infection experiments are in progress with a species of *Fusarium* and one of *Rhizoctonia* which are thought to be possible causes of a collar rot of tea. A form of oedema, characterized by the development of numerous minute translucent swellings on the under side of the leaf, has been observed on tea in one estate.

Inoculation experiments in the laboratory have shown that the *Phytophthora* responsible for the bud rot of coco-nut palms is not readily transferred to cacao pods in Ceylon. The nut fall of areca palms [*Areca catechu*] caused by the fungus *Phytophthora omnivora* var. *arecae* [*P. arecae*: see this *Review*, iv, p. 165] was prevalent in the Kegalla district and was accompanied by a rot of the crown of the palm, which in some cases proved fatal.

A die-back of dadaps [*Erythrina*] occurred after topping the branches. The cortex turned yellowish and developed olive-green, water soaked blisters, 1 to 2 cm. in diameter. These blisters dried up and the cortex fell away from the wood. Young shoots may develop from the affected branches, but these also subsequently die back. Pinkish-white pustules of spores of a species of *Fusarium* were obtained from the lenticels of the diseased bark and cultures of the same fungus were grown from the inner diseased tissue.

Inoculations with these have reproduced the symptoms described and the fungus was successfully re-isolated.

Experiments at Peradeniya indicate that the bunchy top disease of plantains spreads through the soil, probably as a root infection, although no causal organism has been isolated as yet. All the varieties tested proved equally susceptible. A stem disease of plantains was found to be caused by *Marasmius semiustus*.

Other diseases recorded include those caused by *Rosellinia arcuata* on fig, *Glomerella gossypii* on cotton, *Sclerotinia zeylanica* on *Crotalaria*, *Sclerotium rolfsii* on *Vigna oligosperma*, a species of *Rhizoctonia* on gum [? *Eucalyptus*] seedlings, and also on those of *Albizzia*, and a black rot (*Corticium*) on *Amherstia*.

HECTOR (G. P.). **Appendix 1. Annual Report of the Economic Botanist to the Government of Bengal for the year 1923–24.** —*Ann. Rept. Dept. of Agric. Bengal for the year 1923–24*, pp. i–v, 1925. [Received January, 1926.]

The following references are of interest in the mycological section of this report.

Four fungi, namely, *Colletotrichum*, *Gloeosporium*, *Fusarium*, and one undetermined were isolated from diseased betel vines [*Piper betle*] showing a yellow discoloration and wilting of the leaves and a blackish-brown decay of the roots [see also this *Review*, iv, p. 332].

A pure culture of *Rhizoctonia* [? *bataticola*: see this *Review*, v, p. 20] from America was inoculated into thirty jute plants (variety D. 154) with positive results in eleven cases, two of which eventually produced *Macrophoma* [*corchori*] pycnidia [see this *Review*, iv, p. 349].

An obscure disease of bananas, characterized by 'bunching' of the crown and a corrugated and elongated appearance of the leaves, was reported from Calcutta.

Phoma solani caused much damage to brinjal [*Solanum melongena*] at Comilla Farm.

Annual Report of the Director of the Georgia Experiment Station for the year 1924.—pp. 64–89, 6 figs., 3 diags., 1 graph, 1925.

An account is given of the incidence of *Puccinia dispersa* in selfed rye plots and of *P. graminis* and *P. triticina* in a number of wheat varieties, several of which showed marked resistance to one or the other of these rusts while Brown Bearded (204) and Imperial Amber (288) were resistant to both.

Pear blight [*Bacillus amylovorus*] was extremely severe on all varieties, even the Pineapple pear [see this *Review*, iii, p. 278] showing symptoms on a few terminal branches.

Successful results have been obtained in spraying peaches against brown rot [*Sclerotinia cinerea*] with the New Jersey dry-mix spray [see this *Review*, ii, p. 506]. A spray made from hydrated lime with artificial heat instead of stone lime in the self-boiled lime-sulphur preparation has proved equally satisfactory with the latter.

Laboratory studies in the physiology of *Sclerotium rolfsii* have shown that it grows best on an acid medium, and fails altogether

develop on media alkaline to phenolphthalein. Preliminary tests indicate that liming the soil of sweet potato beds sufficiently to produce a slight alkaline reaction will prevent attack by this organism.

A comparative study is in progress on the various anthracnose organisms isolated from Chilli pepper [see this *Review*, iii, p. 248]. One of these, *Gloeosporium piperatum*, appears to be an active parasite, capable of infecting sound pepper fruits.

New knowledge. One year's work, Agricultural Experiment Station (Report of the Director: July 1, 1923 to June 30, 1924).—*Missouri Agric. Exper. Stat. Bull.* 228, 86 pp., 12 figs., 1 graph, 1 map, 1925.

The following references in this report are of phytopathological interest. A method has been devised for the preparation of colloidal copper hydroxide [see this *Review*, iii, p. 287] and tests are in progress to determine its efficiency as a fungicide. Severe burning of apple foliage followed applications of Bordeaux mixture a fortnight after the calyx spray, the size of the leaves and fruit being also reduced.

The results of tests in the use of various materials for the treatment of wounds made in excising blister canker of apples [*Nummularia discreta*] showed that tanglefoot gave the best protection. Grafting wax was also satisfactory, but did not adhere so well as tanglefoot. White lead linseed oil paint was useless unless applied twice a year and sodium silicate was totally ineffectual.

The hot formaldehyde treatment (1 pint commercial formaldehyde in 15 galls. water at 118° or 120° F.) for four minutes gave approximately as good control of *Rhizoctonia* [*solani*] and common scab [*Actinomyces scabies*] of potatoes as corrosive sublimate (4 oz. per 30 galls. water for 1½ hrs.).

Varieties and strains of cabbage resistant to yellows (*Fusarium conglutinans*) have shown 3 to 27 per cent. infection compared with 87 per cent. for the ordinary commercial varieties, Wisconsin All Seasons proving the most satisfactory in this respect.

Da Camara (M. de S.) & Coutinho (D. M. de F. P.). **O presente e o futuro das plantações em S. Tomé.** [The present and the future of the plantations in St. Thomas Island.]—*Anais do Inst. Sup. Agron.* [Coimbra], ii, 2, pp. 138–196, 1925.

This paper contains a full account of the general situation in the island of St. Thomas (Gulf of Guinea) as regards plantation crops. In the discussion on p. 169, on the treatment of cacao trees, the authors recommend the use of Bordeaux mixture to which is added an infusion of tobacco and a little molasses as a spray for the control of several injurious diseases prevalent in the island, namely, downy mildew (*Phytophthora faberi*), leaf spot (*Phyllosticta theobromae*), brown rot (*Lasiodiplodia* [*Botryodiplodia*] *theobromae*), and the malformation of the twigs and fruit attributed to *Colletotrichum luxificum*. Two applications are advised, one after the rainy period and the other at the end of June or the beginning of July.

On pages 176 to 190 a description is given of these and the other diseases found in the cacao plantations. *Armillaria mellea* kills the trees in damp soils. *Polystictus persoonii* is a common parasite

found at the base of the trunk. Canker of the branches is attributed to a species of *Nectria* which appears to be widespread in the island. The witches' broom disease, with which *Colletotrichum luxificum* is said to be associated, is of some importance, causing the fruit to fall in great numbers before reaching maturity.

A brief survey (pp. 190–194) follows of the diseases of various other plantation crops. Root rot of coffee is said to be caused by a fungus closely resembling *Rosellinia aquila*, while oil palms (*Elaeis guineensis*) are frequently attacked by a disease which causes the trunk to become hollow and which is attributed to *Ganoderma applanatum*.

JACZEWSKI (A. A.). Бактериальные болезни Хлебных Злаков [Bacterial diseases of cereals.]—*Bull. Appl. Bot. & Plant-Breeding*, Leningrad, xiv, 1, pp. 377–385, 1925. [English summary.]

The author, after a brief review of the literature dealing with the bacterial parasites of cereal crops, of which so far, he states, eight species have been described, records for the first time the occurrence in European Russia of the disease of wheat known in America under the name of black chaff, caused by *Bacterium translucens* var. *undulosum* [see this *Review*, iv, pp. 146, 160, 335]. The disease was found by him in samples (some of them dating as far back as 1910) of different varieties of wheat from the provinces of Voronezh, Poltava, Kharkoff, Kieff, Don Region, Crimea, and the Caucasus (governments of Kuban and Elisavetpol). It was also diagnosed in a sample, dating from 1893, from Sunpan, China.

The fact that the infected samples originated from localities so widely distant from each other indicates, in the author's opinion, that the disease must be widely distributed in Russia, where it has previously escaped detection owing to the comparatively small damage done by it. The age of some of the samples is evidence of its long standing, and the author is inclined to concur with Erwin Smith that the disease was primarily introduced into the United States with wheat seed of Russian origin.

BAILEY (D. L.) & GREANEY (F. J.). **Preliminary experiments on the control of leaf and stem rusts of Wheat by sulphur dust.** —*Scient. Agric.*, vi, 4, pp. 113–117, 4 graphs, 1925.

The experiments described were carried out with the object of determining the number, optimum rate, and most effective time of applications of sulphur dust for the purpose of controlling wheat rusts [*Puccinia graminis* and *P. triticina*], at Winnipeg, in the summer of 1925, when there was a severe epidemic on the College Farm before the end of the growing season. Dusting was begun before stem rust appeared, though there was a light scattering of *P. triticina* at the time, and was carried out by means of a Niagara Blower gun, using Niagara sulphodust [see this *Review*, iv, p. 557], guaranteed 92 per cent. sulphur. The treatment was continued for about seven weeks, between 2nd July and harvest.

The results [which are summarized in tabular form] indicate that dusting every two weeks at the rate of 15 lb. sulphur per acre has no effect on rust. On plots dusted once a week a considerable re-

duction in rust was, however, evident, as well as an increase in both yield and grade. Two and three dustings a week showed a still more marked reduction in rust infection and a further improvement in yield and grade. With three dustings a week the yield was 34 bushels per acre more than in the check plots, and this represented an increased value of $42 per acre, after allowing for the cost of the dust but not for labour or machines. As shown in the graphs the curves of the incidence of leaf and stem rust are almost identical. There is a gradual and relatively slight reduction in the percentage infection up to a certain number of applications per week and then a marked reduction. This occurred between two and three applications per week, but when the amount of sulphur was increased to 30 lb. at each application, the chief reduction occurred between one and two applications weekly.

SIGRIANSKY (A. M.). Головня и меры борьбы с нею. [Cereal smuts and their control measures.]—Pamphlet of the *Narkomzem* [*People's Commissariat of Agriculture*], Moscow, 64 pp., 24 figs., 1925.

This is a semi-popular account of the different species of smuts attacking wheat, rye, oats, barley, millet [*Panicum miliaceum*], and maize in European Russia, where these diseases yearly levy a heavy toll, varying from 5 to over 70 per cent. of the crops. In North Russia and Siberia the prevalent smut of wheat is *Tilletia tritici*; in south and south-east Russia this species mainly occurs on winter wheats, while the spring wheats are chiefly attacked by *Ustilago tritici*. *Tilletia levis* occurs comparatively rarely in Russia and is common only in Transcaucasia. *Tilletia secalis* is stated to be undergoing a dangerous extension, the damage done by it in certain districts amounting in some seasons to 45 per cent. or more of the crop. Biologically it appears to be closely related to *T. tritici*, as it was found attacking both wheat and hybrids of wheat and rye. Another parasite of rye which is gaining ground in Russia is the stem [flag] smut, *Urocystis occulta*, and lately it has caused not inconsiderable losses in some localities. In recent years millet has suffered heavily from the attacks of *Ustilago panici-miliacei*, the losses due to it amounting in some cases to over 82 per cent. of the crop.

A comprehensive review is given of the usual control measures against these diseases, with special reference to their application under present conditions in Russia, and the paper concludes by a discussion of the administrative help to be extended to the population with a view to the spreading and popularization of seed disinfection and cultural methods for checking the ever-increasing menace offered by these diseases.

ZAPROMETOFF (N. G.). Данные по развитию головни хлебных злаков в Туркестане в **1922–24** годах. [Data on the development of cereal smuts in Turkestan in the period 1922 to 1924.]—Pamphlet of the *Turkestan Entom. Stat., Phytopath. Sect.*, Tashkent, 26 pp., 5 figs., 1 map, 1924. [Received January, 1926.]

The main point of interest in this paper is the detailed description of the enormous extension in Turkestan of the various smuts

of wheat (*Ustilago* and *Tilletia* spp.) since 1922, before which year these diseases are said to have been of no great economic importance. Their wholesale spread (chiefly of *Tilletia tritici* and *T. levis*) is attributed partly to the lowered standard of agriculture of recent years, but principally to the great influx into Turkestan in 1922 of peasant refugees from the famine districts in the Volga basin, who brought with them infected seed grain. In 1923 the infection extended over an area of 120,000 dessiatines [roughly 350,000 acres], the loss of crop from these diseases being estimated at three million poods [about 50,000 tons]. Owing to vigorous administrative measures taken in 1923 to popularize seed treatment, the further spread of the infection was arrested, and the total infected area somewhat reduced, although in some districts it still continued to gain considerable ground: e. g., in Fergana the infected area in 1924 was 17,000 as against 1,000 dessiatines in 1923.

The rest of the pamphlet reproduces for the most part the information on cereal smuts contained in the author's text-book referred to elsewhere [see below, p. 174], and a map is appended showing the distribution of the various smuts in the territory of Turkestan.

NOVOPOKROVSKY (I. V.) & SKASKIN (F. D.). Влияние температуры на прорастание хламидоспор головни хлебных злаков (род **Ustilago**). [Effect of temperature on the germination of the chlamydospores of cereal smuts (genus *Ustilago*).]—Pamphlet of the *North Caucasus Regional Land Administration*, Rostoff-on-Don, 28 pp., 1 pl., 1925. [English summary.]

After a cursory review of the literature dealing with the effect of temperature on the germination of the spores of cereal smuts (*Ustilago* spp.), the authors detail at some length their experiments made in December, 1924, at the Plant Pathology and Microbiology Laboratory of the Institute of Agriculture and Amelioration in Novotcherkask [Don Región, south Russia]. The experiments bore on the germination of the spores of *Ustilago avenae*, *U. hordei*, *U. maydis*, *U. nuda*, *U. panici-miliacei*, and *U. tritici*, at temperatures ranging (at intervals of 5° each) from 0° to 40° C., with special reference to the period of time required for the appearance of the first signs of germination (rapidity of germination) and to the percentage of spores germinating (energy of germination) at each particular temperature.

The results indicated that these fungi fall into two groups according to their temperature relations, namely, one comprising *U. avenae, U. hordei, U. nuda,* and *U. tritici*, with minimum below 5°, optimum about 20° to 25°, and maximum between 25° and 30° C., and the other comprising *U. panici-miliacei* and *U. maydis*, for which the cardinal points are displaced from 5° to 10° higher. It was noted that the closer the temperature tested approached the optimum, the earlier the first germinations occurred and the higher was the percentage of germination, the curves plotted for the rapidity and for the energy of germination corresponding very closely to each other. At temperatures very close to the minimum and maximum points a depression of the vegetative energy of the fungi was observed, resulting in the production of stunted and deformed promycelia [see this *Review*, v, p. 29], while the optimal

temperature for mycelial growth was apparently below that for the germination of the spores. All the experiments were made with freshly gathered spores, the indications being that a period of rest is not necessary, while unpublished data indicate that the germinability of the spores decreases in direct proportion to the length of time of their keeping. All the spores germinated as readily in tap and in distilled water as in artificial media, with the exception of the spores of *U. tritici*, which apparently germinated best in Artary's solution (NH_4NO_3, 0·25 gm., KH_2PO_4, 0·1 gm., $MgSO_4$, 0·025 gm., $FeCl_3$, traces, H_2O, 100 c.c.).

The above results, in the author's opinion, suggest the idea that the smut fungi have adapted themselves to the temperature requirements of their hosts. Thus, in cases where the hosts are infected early in their development (*U. avenae, U. hordei, U. panici-miliacei*) the cardinal temperature points for the germination both of the seed grain and of the spores appear to coincide very closely, while in the case of *U. nuda* and *U. tritici*, which infect their hosts during the blossoming period, the optimal temperature for the germination of the spores stands apparently very close to the average temperature at the flowering stage of the hosts. The same has also been observed in regard to *U. maydis*, which infects throughout the life of its host.

SPANGENBERG (G. E.). К поражаемости сортов яровой Пшеницы вонючей головней [On the susceptibility of varieties of spring Wheats to bunt.]—*Protection of Plants in Ukraine*, i, 1–2, pp. 33–37, 1925.

This paper is a progress report on experiments made in 1924 at the Phytopathological Experiment Stations at Kharkoff and Ekaterinoslav [Ukraine] with a view to testing different varieties of spring wheats for their resistance to bunt (*Tilletia tritici*). The tests included 18 named local varieties and pure lines, and the Kitchener and Marquis varieties from the United States. The results confirmed the findings of foreign investigators that hard wheats (*Triticum durum*) as a class are much more resistant to this fungus than common wheats (*T. vulgare*). In regard to the latter, the indications are that they may be divided into three groups, namely: the awned varieties (e.g., var. *ferrugineum* and var. *erythrospermum*) appear to be the most susceptible, and the awnless red-grained varieties (var. *lutescens* and var. *milturum*) the most resistant, while the awnless white-grained varieties (*albidum*) would seem to form an intermediate group. The author states, however, that these results need further confirmation, as the individual tests comprised a small number of plants and were made during one season only, under somewhat abnormal conditions, the summer of 1924 being exceptionally dry. A more detailed report on these experiments is to appear elsewhere.

BODNÁR (J.) & TERÉNYI (A.). **Beiträge zur Biochemie der Wirkung von Kupferverbindungen auf die Steinbrandsporen des Weizens.** [Contributions to the biochemistry of the action of copper compounds on the spores of bunt of wheat.]—*Chem. Zeit.*, xlix, 128, p. 902, 1925.

This is a preliminary account of experiments conducted at the

Institute of Plant Biochemistry in Budapest and the Medico-Chemical Institute of Debrečen University.

The unpublished results of recent experiments by the senior author and Dr. Irene Villanyi showed that the spores of bunt [*Tilletia tritici* and *T. levis*] adsorb the following amounts of copper during 5 to 10 minutes' immersion in (*a*) copper sulphate, (*b*) copper chloride, (*c*) copper nitrate, and (*d*) copper acetate: 0·25 per cent. solution, (*a*) 1·10, (*b*) 1·16, (*c*) 1·25, and (*d*) 1·72 per cent.; 0·5 per cent., (*a*) 1·21, (*b*) 1·09, (*c*) 1·26, and (*d*) 2·31 per cent.; 1 per cent. solution, (*a*) 1·13, (*b*) 1·04, (*c*) 1·24, and (*d*) 3·37 per cent.; 2 per cent. solution, (*a*) 1·15, (*b*) 1·20, (*c*) 1·25, and (*d*) 3·32 per cent. Copper acetate is thus shown to be adsorbed to a much greater extent than any of the other compounds.

In the authors' experiments on the action of very dilute copper solutions on bunt spores the following results were obtained. In 10 c.c. of calcium nitrate nutrient solution 9 mg. of spores failed to germinate when the solution contained 0·1 mg. (0·001 per cent.) copper sulphate. The spores adsorbed only 0·2 per cent. of copper, and those which were filtered off germinated normally; thus it is not the amount of copper adsorbed, but that present in the solution, which inhibits germination. A 0·0001 per cent. solution merely retarded germination, while one of 0·00001 per cent. produced no effect on the spores. When 50 mg. of spores were used instead of 9 mg., germination occurred in a 0·001 per cent. copper sulphate solution and no copper was found in the filtered solution, the adsorption by the spores of the entire quantity of copper present failing to inhibit germination.

Calculations based on these data indicate that when less than 400 bunt spores are present in 1 mg. of soil moisture containing 0·00001 mg. of copper, no germination will occur. Hence it is very important that dusts should contain copper in a soluble form. Copper compounds which are insoluble in soil moisture are not adapted for use as dusts.

NAGEL (W.). **Ueber die Einwirkung höherer Temperaturen während und nach einer Beize mit verschiedenen Beizmitteln.** [The effect of high temperatures during and after steeping with various disinfectants.]—*Angew. Bot.*, vii, 5, pp. 304–319, 1 graph, 1925.

Spores of *Tilletia tritici* were immersed for one hour in solutions of varying strength of acetone mercuric chloride, copper chloride, segetan-neu (104 b, improved preparation), and uspulun at temperatures of 18°, 25°, 30°, 35°, 40°, 45°, and 48° C.; rinsed six times within half an hour after steeping; and sown on soil to ascertain the *dosis curativa* [see this *Review*, ii, pp. 551 et seq.] at each temperature. In order to determine the toxic effect on the seed, seed of Friedrichswerther Berggold wheat was immersed for one hour in each of the preparations at the concentration and temperature of the *dosis curativa*, and subsequently spread out on damp filter paper in germination dishes held at 20°.

Control tests with hot water showed that temperatures up to 45° exercised no inhibitory effect on spore germination during the one-hour period of immersion; a temperature of 48° retarded

germination by one day and reduced it from 100 to 75 per cent. Temperatures of 45° to 48° exercised a barely appreciable and purely temporary reduction in the germinative energy of the wheat.

The results of the experiments [which are presented in tabular form] showed that for acetone mercuric chloride the *dosis curativa* gradually decreases with a rise in the temperature from 18° to 30°, and suddenly falls from 30° to 35°. The *doses curativae* from 18° to 35° reduced the germinative energy of the wheat. From 35° upwards the quantities of mercury necessary for the destruction of the spores are so minute (0·02 per cent. at 35° and 0·0012 per cent. at 48°) that they cause no injury to the seed.

With copper chloride the data as regards the *dosis curativa* were similar, but the germinative energy and germination of the seed were impaired at all the spore-destroying concentrations and temperatures.

In the case of segetan-neu, the *dosis curativa* sinks slightly and almost uniformly from 18° to 48° by 0·003 per cent. of the Hg content per 10°. The requisite quantity of Hg for the destruction of the spores at 48° was found to be only 0·0075 per cent. At this temperature, however, the germinative energy of the wheat was reduced.

The *dosis curativa* for uspulun was 0·2 per cent. at 18° and 0.0075 per cent. at 48°, i. e., four times the amount of Hg used in segetan-neu at 18° and only half the quantity in the same preparation at 48°. This may possibly be explained by the greater adsorptive and penetrative properties of segetan at low temperatures, whereas at 45° to 48° the same factors are slightly more in evidence in uspulun and acetone mercuric chloride than in segetan.

Experiments were further undertaken to determine the effect of drying seed sprinkled with segetan (0·1 to 0·35 per cent.) and uspulun (0·5 to 1 per cent.) in an apparatus heated to 40° for 30 minutes, compared with ordinary drying in the air. In order to test the effect of the treatment on the spores, wheat seed was artificially infected at the rate of 0·3 gm. of spores per 50 gm. seed grain.

In the case of segetan the drying process exercised a favourable effect on the germinative energy of the seed (which was increased by 10 to 11 per cent.) at all concentrations up to the prescribed 0·2 per cent. At 0·275 per cent., germinative energy was reduced by 8 and germination by 7 per cent. Uspulun at 0·25 to 0·5 per cent. consistently increased germinative energy by 4 to 7 per cent.; at 0·95 per cent. and 1 per cent., this factor was reduced by 13 and 22·5 per cent., respectively, while at the latter concentration germination decreased by 10 per cent. The *doses curativae* for segetan-neu and uspulun in the sprinkling method were determined to be 0·175 and 0·7 per cent., respectively.

In the experiments with seed dried gradually in the air after sprinkling, germinative energy was increased by 6 to 11 per cent. by sprinkling with segetan up to 0·2 per cent. Only at 0·325 per cent. was a reduction in germinative energy and germination noticeable (8 and 10 per cent., respectively). Uspulun failed to increase germinative energy to any appreciable extent; at 0·9 per cent. it caused a reduction of 17 to 20 per cent. in germination.

It is evident from these investigations that high temperatures, coupled with the requisite quantities of disinfectants, may be detrimental to the seed. The risk attaching to the use of copper salts, compared with the comparatively innocuous mercury compounds, is also apparent. The consumption of Hg is lowest in segetan, and in uspulun at 40°, at which temperature only $\frac{1}{5}$ of the quantity of mercury necessary for spore destruction at 18° is required. The experiments with segetan show that complete destruction of the spores can be achieved by this method, not merely a retardation of germination which, as Gassner has shown [see this *Review*, iv, pp. 231, 341], may be counteracted by soil factors under certain conditions.

Seed treatment at high temperatures on a large scale should always be preceded by laboratory tests to determine the *dosis curativa* at 35° to 40°.

RIEHM (E.). **Beizapparat Degesch.** [The Degesch steeping apparatus.]—*Mitt. Deutsch. Landw. Gesellsch.*, xl, 22, p. 424, 1 fig., 1925.

This paper is one of a series of reports on the testing of machinery. A brief description is given of the Degesch apparatus [see this *Review*, iv, p. 623], by means of which 6 to 7 cwt. of wheat seed-grain can be treated against bunt [*Tilletia tritici* and *T. levis*] per hour. The cost of this apparatus is M. 400.

GARKE. **Das Beizen der diesjährigen Herbstsaat.** [The disinfection of the current year's autumn seed-grain.]—*Die Kranke Pflanze*, ii, 11, pp. 224–226, 1925.

The writer discourages the indiscriminate use of the new disinfectant dusts [see next abstract], which are stated to be rapidly supplanting copper sulphate and other liquid preparations of proved efficacy. Apart from the doubtful fungicidal value of many of the new dusts, they have two serious drawbacks, namely, an injurious effect on the eyes and respiratory organs of the operators, and the expense of the apparatus required.

BAUNACKE. **Zur Trockenbeize.** [The dry method of seed disinfection.]—*Die Kranke Pflanze*, ii, 11, pp. 226–227, 1925.

In reply to Garke's criticisms of the new dusts [see preceding abstract], it is pointed out that the official testing of each new preparation (of which 67 for the control of bunt [*Tilletia tritici* and *T. levis*] alone were submitted for analysis to the Plant Protection Service in the autumn of 1925) on an extensive scale is an obvious impossibility. The tests are repeated, however, on a similar plan, at five or six experiment stations in different parts of Germany, and the collective data thus obtained should suffice to give a reasonably accurate indication of the value of the preparations in the field. Many farmers in Saxony are stated to neglect seed disinfection altogether on account of the difficulties connected with the use of liquid preparations, and it is hoped that the simplicity of dusting will promote the widespread adoption of regular treatment. The writer believes that the few remaining objections to the use of dusts will shortly be overcome [see also this *Review*, v, p. 117].

STOCKHAUSEN. **Trockenbeize.** [The dry method of seed treatment.]—*Mitt. Deutsch. Landw. Gesellsch.*, xl, 33, pp. 592–593, 1925.

At the recent travelling exhibition of the German Agricultural Society two types of apparatus for the dusting in bulk of cereal seed-grain were on view. F. Neuhaus Ltd., Maschinenfabrik, Eberswalde, Ackerstr. 5–6, supply a continuously working machine, known as Neusaat, which has to be connected with an electrical plant and which is capable of treating very considerable quantities of grain per hour. A similar apparatus, treating 500 to 1,000 kg. per hour, is supplied by F. Thränhardt Ltd., Leipzig, Neuer Markt 31–33.

For the treatment of smaller quantities of grain (50 to 100 kg.) there are several machines on the market which can either be worked by hand or attached to an electrical plant. With the Primus apparatus (G. Drescher, Maschinenfabrik, Halle-an-der Saale, Äussere Delitzscherstr. 40–43), or the Ideal [see this *Review*, v, p. 117], 300 kg. can be treated per hour.

The market prices of these machines are quoted as M. 850 for Neusaat, M. 160 for Primus (or M. 175 with pulley), and M. 60 for Ideal.

MÜLLER (H. C.) & MOLZ (E.). **Fütterungsversuch mit trockengebeiztem Weizen.** [Feeding experiment with dusted Wheat.]—*Deutsche Landw. Presse*, lii, 37, p. 440, 1925.

The writers conducted a test [particulars of which are given] to ascertain the effects of feeding poultry with the refuse of wheat treated with the following dusts: trockenbeize 225 (Magdeburg S.O.), 5 gm. per kg.; uspulun, 3 gm.; abavit, 3 gm.; trockenbeize 1512 (Mainz), 4 gm.; trockenbeize Merck, 10 gm.; the same with mercury, 10 gm.; trockenbeize Sch. 614 (Höchst), 3 gm.; and porzoltrockenbeize, 3 gm. Comparative figures of the weight of the birds before and after the experiment (which lasted about a fortnight) showed that abavit caused a decrease of 140 gm. per bird, while an increase was observed in all the other cases. There was no lack of appetite (though the treated grain was not taken with the same relish as the untreated) and the healthy appearance of the birds was maintained.

GORDON (W. L.). **Studies concerning injury to seed Oats after smut disinfection.**—*Sixteenth Ann. Rept. Quebec Soc. Prot. Plants, 1923–1924*, pp. 79–94, 4 pl. [Received 1925.]

In this paper the author describes in detail experiments carried out at Macdonald College, Quebec, in 1922–3 and 1923–4, with three varieties of hulled and one of hull-less oats, to determine the effects of formalin, copper carbonate, and uspulun on germination.

The formalin strengths tested ranged between one pint to 60 galls. water and one pint to 2 galls. Only the latter had any marked injurious effect on the germination of hulled oats, but the hull-less (Liberty) oats and Marquis wheat were appreciably affected at greater strengths than 1 in 40. In all cases the grain was dipped for 10 mins., drained for 10 mins., and covered for an hour but a

test of the duration of treatment with 1 in 40 strength showed that this is not an important factor unless greatly prolonged, Liberty oats being again an exception. Increasing the temperature of the solution decreased the germination of Liberty but not of hulled oats. Seed injury after dry storage for several months was also noticeable only in the case of the Liberty variety. Presoaking the seed in water for three hours and then draining and keeping moist for a further three hours prior to treatment has apparently a stimulative effect on germination and reduces the seed injury to Liberty.

The results of experiments to determine the relation of soil moisture to formaldehyde injury and the value of a milk of lime dip in reducing this injury show that injury is confined chiefly to the radicle, the plumule being little affected, while the milk of lime dip favours the development of the root system and increases the germination percentage. Although there was little difference between the percentages of germination in dry (8·5 per cent. moisture) and wet (19·6 per cent.) soil, the field tests suggested that there would have been a greater reduction in the dry soil if the moisture content had not been made up to equal the wet soil after three days.

A comparison of the effects of different smut treatments with special reference to seed injury, using the dip, sprinkle, spray, and dust methods, showed that dry copper carbonate (2 oz. per bushel) had no material effect on germination on either hulled or Liberty oats, except that a slight retardation was observed in the treated seed of the former when germinated at the end of 10 months. Uspulun (0·25 per cent. solution, 2 hours' dip) had no injurious effect on the germination of hulled oats and appeared to act as a stimulant in the case of the Liberty variety; dry storage for a month did not reduce germination.

Petri (L.). **L'agente del marciume radicale degli Agrumi.** [The causal agent of root rot of Citrus trees.]—Reprinted from *Ann. R. Ist. Sup. Agrario e Forestale*, Ser. II, i, 7 pp., 4 figs., 1925.

Lesions of the bark of citrus trees similar to those produced by *Pythiacystis* [*Phytophthora*] *citrophthora* in California were observed by Fawcett in Sicily in 1923 [see this *Review*, iv, p. 412]. Dufrénoy subsequently isolated an oomycete closely resembling *Blepharospora* from citrus trees affected with gumming and root rot in Corsica. The author has recently succeeded in isolating a similar parasite from citrus trees affected with root and collar rot in Sicily. These trees were suffering from a necrosis limited to a clearly defined zone and extending from the base of the trunk upwards. In macroscopic characters the fungus concerned is like *B. cambivora*, but it differs from the latter in producing sporangia more freely on solid culture media, such as carrot and agar, than in mineral solutions [see this *Review*, iv, p. 452]. As this is regarded by the author as one of the main differences between the genera *Blepharospora* and *Phytophthora*, the citrus parasite is thought to belong to the latter genus. Its zoosporangia are lemon-shaped, fairly large (54 to 63 by 33 to 35 μ), markedly papillate, and with short stalks, on

which they are sometimes inserted laterally. Oospores were not observed.

SHIVER (H. E.). **Disinfecting and washing Citrus fruit.**—*Chem. & Metall. Engin.*, xxxii, 16, p. 812, 1925.

So far the use of borax solutions for the control of the citrus diseases, stem-end rot, due to *Phomopsis* [*citri*] and *Diplodia* [*natalensis*], and blue mould [*Penicillium digitatum* and *P. italicum*], recommended by Fulton and Bowman [see this *Review*, iv, p. 164], has not been extensively adopted in Florida owing to complaints from the northern markets of a greyish deposit on the surface of treated fruit.

The result of chemical analyses [which are detailed] of the solutions indicated that the daily addition of borax for the purpose of keeping the solution at the required strength increased the total borax content from 5·49 per cent. in a freshly prepared solution to 12·88 per cent. after a fortnight. Fruit treated with a solution of the latter strength carries away a thin film on its surface which, on drying, deposits crystals of sodium borate. This serves to lower the density of the tank solution and imparts a greyish tinge to the fruit, which is also partly due to the coating with borax of the rollers of the apparatus. The calcium precipitate from the soluble sodium soap used in the washing tank also forms a floating, slimy scum which adheres to the fruit. These objectionable features of the treatment can be obviated by the use of soft water.

AVERNA-SACCÁ (R.). **Segunda contribução para o estudo das molestias cryptogamicas do Cafeeiro.** [Second contribution to the study of the fungous diseases of Coffee.]—*Secretaria da Agric., Comm. e Obras Publieas, São Paulo,* 63 pp., 21 figs. (1 col.), 1925.

The author discusses the diseases affecting coffee in Brazil, in continuation of his previous studies (*Secretaria da Agric., S. Paulo,* 1917), and refers to various statements regarding the presence of *Hemileia* [*vastatrix*] in that country, which he characterizes as pure inventions.

Anthracnose is attributed to *Glomerella coffeicola* n. sp., and is characterized by the appearance of dark spots on the seedlings and black patches on the leaves and stems of older plants. Details are given of the development of certain imperfect stages which the author considers to be included in the life-cycle of the fungus, namely, *Colletotrichum incarnatum* Zimm., *Diplodia coffeicola* Zimm., and *Cytosporina coffeicola* n. sp. The ascigerous form developed on dead parts kept damp at 15° to 20° C. One or more perithecia arise in the conidial or pycnidial stroma. They are pyriform, oval, or irregular, depressed, with cylindrical-clavate, paraphysate asci, containing eight polystichous, cylindrical or cymbiform, curved, hyaline to greyish spores, 32 to 40.5 by 13 to 16 μ in diameter. Spraying with Bordeaux mixture is recommended for the control of the disease, which caused considerable damage in 1914.

Since October 1923, *Pestalozzia coffeicola* Averna has caused some damage in the provinces of Sertãozinho and Ribeirão Preto. It is

often found in conjunction with the next fungus. The affected leaves become covered with pale blotches, which gradually darken to reddish-brown and converge, causing the leaf to shrivel. The conidia are formed in minute, black acervuli, especially numerous at the base of the leaf blade. The conidia are fusiform, 4-septate, and 16·2 to 27 by 7·36 to 9.7 μ in diameter. The two apical cilia are 24 to 29·4 by 1 to 1·2 μ.

In July 1922, a drying up of the leaves, which turned dark grey, brown, or black, was noticed on some plants. This condition was especially evident in shaded plantations and on compact, poor soils, although also found to a certain extent in exposed situations. It commenced with the formation of small, discoloured, scattered, translucent patches, which gradually increased in size and became yellow or orange, bounded by a small, darkish grey zone, and covered with a velvety, black efflorescence. A similar phenomenon was observed on cherry trees, either during the ripening period or later, causing decay or drying up of the fruits. The fungus on these spots is considered to be parasitic and is named *Clasterosporium coffeanum* n.sp. The conidia are elliptical or club-shaped, at first hyaline then olivaceous, 3 to 6 or rarely 7-septate, slightly constricted at the septa, and 24·3 to 43·2 by 12 to 13·5 μ in diameter.

Serious damage due to root rot was reported in the north-eastern coffee-growing areas in 1914, and since then in Desealvada and Araraguara. Although the symptoms of attack resemble those associated with *Dematophora* [*Rosellinia*], the cause is thought to be distinct. The affected roots contained a hyaline, gradually darkening mycelium in the cortex, and penetrating the medullary rays, where it was associated with severe gumming. Ultimately a large stroma was formed below the periderm, which it ruptured. From the surface of the stroma dark, sinuous, simple or branched hyphae grow out, which are thought to be conidiophores, though no conidia were seen.

Other fungi described by the author and considered to be more or less parasitic on coffee in Brazil are *Hendersonia coffeicola* Del., *Stictis coffeicola* Averna, and *Lachnea hemisphaerica* (Wigg.) Gill.

The condition known as 'café chocho', characterized by an imperfect development of the berries, is usually attributed to environmental conditions such as drought, high humidity, or poor cultivation. The author has found cases in which the bushes bore quantities of roughened, blackened, sometimes decayed berries, which tended to fall prematurely, and which could not be caused by the above conditions, and he attributes the damage to a number of fungi which he found on the berries. A description is given of *Chaetophoma coffeicola*, *Nectria coffeigena*, *Sphaerostilbe flavida*, *Coniothyrium coffeae*, and *Diplodia coffeicola*, all of which may attack the berry during ripening. Recommendations are given for the control of this disease.

Ashby (S. F.). **The perfect form of Stilbum flavidum Cke in pure culture.**—*Kew Bull. Misc. Inform., 1925,* 8, pp. 325–328, 1 pl., 1925.

An outbreak of the American coffee leaf disease in Trinidad in

1924 enabled the author to isolate the causal organism (usually known as *Stilbum flavidum*) by a technique which is described. By culturing the fungus on moistened bread, a dense growth of the '*Stilbum*' form was obtained, and after twelve days a few much larger bodies began to appear and finally developed into pilei conforming to Maublanc and Rangel's description of *Omphalia flavida*. The genetic relationship of the two fruit bodies suggested by these authors is therefore definitely established for the first time. Basidiospores were scantily formed in the cultures.

The '*Stilbum*' fructifications are 2·0 to 2·5 mm. in height and with heads 0·25 to 0·33 mm. in diameter, secondary stalked heads frequently arising from the primary ones. No spores were found on them and the large peripheral end cells give rise only to hyphae in water and on culture media. The fungus is disseminated and new infections are produced by the entire heads detached from their stalks. Attempts to obtain the perfect form on the affected leaves were unsuccessful.

Averna-Saccá has recently described [see preceding abstract] conidial synnemata having vermilion spore heads on coffee in Brazil which he refers to *Sphaerostilbe flavida* Mass., citing *Stilbum flavidum* Cke, *Stilbella flavida* Kohl., and *O. flavida* Maubl. & Rang. as synonyms. This form, however, must be quite different from that described above. As *Stilbum flavidum* is a Basidiomycete, the combination *Sphaerostilbe flavida* Mass. is considered to be untenable.

WINTERS (N. E.). **Manual para el cultivo del Algodonero en la República Argentina.** [Manual for Cotton cultivation in the Argentine Republic.]—*Min. Agric. Nac.* (*Buenos Aires*), *Secc. Prop. e Inform. Circ.* 539, 78 pp., 27 figs., 1925.

In the second part of this manual the author gives very brief notes on the following diseases, which are said to be more or less common on cotton in the Argentine: anthracnose (*Glomerella gossypii*); bacterial blight (*Bacterium malvacearum*); cotton wilt (*Fusarium vasinfectum*), not yet very widespread; and sore shin (*Rhizoctonia*) [*solani*]. Methods of control are suggested in each case.

KALANTARIAN (P.). **Zwei neue Bakteriosen der Baumwollstaude in Armenien.** [Two new bacterioses of the Cotton plant in Armenia.]—*Centralbl. für Bakt.*, Ab. 2, lxv, 14–21, pp. 297–301, 1925.

In 1924 two serious new bacterial diseases of cotton were observed in Armenia, one affecting the roots of seedlings and the other occurring on mature plants.

The former disease appeared in May, chiefly in the districts of Etchmiadzin, Kamarlu, and Erivan, where up to 30 per cent. of the seedlings in certain fields were attacked. The first symptom was a pronounced wilting, followed by withering and drooping of the foliage and eventual desiccation. In some cases a thickening of the stem at the root collar was observed. The roots were dry, with a brittle, blackish-brown cortex, which contained numerous bacteria but no fungi.

Of the numerous isolations of these bacteria, four of an organism forming yellow colonies produced the typical symptoms of the disease on King, Navrotzki, and Russels cotton seedlings, both wounded and unwounded, and grown from sterilized and unsterilized seed. The failure of seed sterilization to control the disease indicates that infection proceeds from the soil. The King variety was the most susceptible.

The morphological and physiological characters of the causal organism are as follows: short rods with rounded ends, 1·25 to 2·5 (average 1·8) by 0·5 to 0·7 μ, motile with several peritrichous flagella; staining readily with the usual colouring agents, Gram-negative; spore formation not observed; on all meat agar media the colour of the colonies ranged from whitish or greyish-white in the early stages of growth to yellow at maturity; gelatine was liquefied, milk coagulated, and indol formed; dextrose, cane sugar, and mannite were fermented; and there was no reduction of nitrates.

This organism is evidently closely related to *Bacterium herbicola aureum* and to *Phytobacter lycopersicum* [see this *Review*, iii, p. 302; iv, p. 319], but since it cannot be identified with either, the new name *Bact. erivanse* is proposed.

The second disease was observed in the districts of Kamarlu and Sardarabad in August and September. The symptoms consisted of a pale yellowish intervenous discoloration of the foliage, followed by wilting, desiccation, and death in 10 to 15 days. Sections through the stalks showed a blackish-brown discoloration extending the entire length of the vascular bundles.

Eight strains of bacteria were isolated from infected material on potato agar and subsequently proved to be identical. Owing to the lateness of the season no inoculation experiments could be undertaken, but it is regarded as highly probable that the isolated bacterium is the cause of the disease, which is stated by the local growers to have greatly increased in distribution and virulence during the past three years.

The morphological and physiological characters of the organism are as follows: short rods with rounded ends, 0·8 to 2·0 (average 1·5) by 0·5 μ, the cells mostly occurring in pairs; spore formation not observed; readily stainable except for the usually eccentric vacuoles; Gram-negative; the colour of the colonies on potato and meat media ranged from white or greyish-white to brown; milk was coagulated and indol formed; no reduction of nitrates or gas formation observed.

The organism could not be identified with any existing species, and has therefore been named *Bact. löhnisi* n. sp.

SARRAMON & PONS (R.). **Tumeur mycosique de la face interne de la joue chez un Annamite.** [Mycotic tumour on the inner surface of an Annamite's cheek.]—*Bull. Soc. Méd-Chirurg. Indochine*, ii, 4, pp. 96–97, 1924. [Abs. in *Trop. Dis. Bull.*, xxii, 12, p. 981, 1925.]

A species of *Monilia* resembling *M. parakrusi*, but not identical as shown by its incapacity to clot milk, was isolated from an ulcerated, hardened tumour formed on the inner surface of a

patient's cheek. This tumour was formed of a stratified epithelium with a close woof of mycelium. It yielded to treatment with potassium iodide.

ANDERSON (C.). **Sur un cas d'otomycose à Sterigmatocystis nigra.** [On a case of otomycosis due to *Sterigmatocystis nigra*.]—*Arch. Inst. Pasteur de Tunis*, xiv, 1, pp. 93–96, 1925. [Abs. in *Trop. Dis. Bull.*, xxii, 12, p. 981, 1925.]

Sterigmatocystis nigra was obtained from the ear of a patient suffering from otomycosis. The cultures were at first non-pathogenic to rabbits, but on repeated passage through media of increasing alkalinity, became pathogenic and the mould was recovered from the rabbits' lesions. The author has, however, repeated this experiment without success.

CASTRILLON (B. A.) & BORSANI (E. P.). **Micosis aspergilar.** [On *Aspergillus* mycosis.]—*Semana Méd.*, xxxii, 17, pp. 924–926, 1925. [Abs. in *Trop. Dis. Bull.*, xxii, 12, p. 981, 1925.]

An Argentine patient with symptoms resembling pulmonary tuberculosis, but with no fever and no acid-fast bacilli, was found, on cultivation from the sputum, to be infected with *Aspergillus fumigatus*. A cure was effected in a fortnight by means of potassium iodide.

ASHFORD (B. K.). **Sprue.**—*Ann. Clin. Med.*, iv, 1, pp. 13–20, 1925. [Abs. in *Trop. Dis. Bull.*, xxiii, 1, p. 45, 1926.]

From the evidence and clinical impressions of 2,500 cases, sprue (which appears to be spreading in the southern parts of the United States) is considered to be one of the most marked examples of a disordered mechanism which makes the colonization of a specific organism, the fungus *Monilia psilosis* [see this *Review*, iv, p. 168], possible in the human body.

Positive benefit has followed the use of *M. psilosis* vaccines in the vast majority of cases. In those quoted, injections were given, as a rule once weekly, of a 1 per cent. sediment of killed culture of *M. psilosis*, suspended in normal salt solution, in increasing doses from 0·1 to 1 c.c. Eight injections were usually required.

WILSON (J. A.) & DAUB (G.). **A common mold that causes black spots on leather.**—*Journ. Amer. Leather Chem. Assoc.*, xx, 9, pp. 400–405, 12 figs., 1925.

In continuation of their previous studies on imperfections in leather due to micro-organisms [see this *Review*, iv, p. 751], the writers state that they have obtained a number of cultures of *Aspergillus niger* from various samples of spotted leather.

This fungus was shown to grow vigorously on chrome calf leather immersed in any strength of sulphuric acid up to 1·5 normal. Its development was rapidly suppressed by dilute solutions of sodium hydroxide.

The best means of preventing the spotting of leather is to keep it dry. Where there is any risk of contamination, the application of an aqueous solution of chlorine (1 part by weight of chlorine to 50,000 parts of water) has been found effective. Corrosive sublimate gave less satisfactory results, ten to twenty times as much

being required as in the case of chlorine, while 1,500 times as much formaldehyde as chlorine had to be used to produce a comparable effect.

PAPE (H.). **Die Hartfäulekrankheit der Gladiolen und ihre Bekämpfung.** [The hard rot disease of Gladioli and its control.]—*Gartenwelt*, xxix, 40, pp. 676–680, 4 figs., 1925.

Serious damage has been caused of recent years in Germany by the hard rot disease of *Gladiolus* bulbs to which Löbner has called attention [see this *Review*, iv, p. 546] without, however, identifying the cause, which the author has now determined as *Septoria gladioli* Pass. The first symptom is the appearance of circular, water soaked, reddish to very dark brown, later deep black, sometimes confluent spots on the sides and base of the bulbs. In the advanced stages of a severe attack the affected tissues harden and become mummified. As a rule the infection penetrates only about 1 to 6 mm. into the tissue.

Microscopic examination of the affected areas showed that the raised, black pycnidia of the parasite, which are just visible to the naked eye, contain elongated, cylindrical, hyaline, mostly four-celled spores (not unicellular, as stated in Rabenhorst's Kryptogamenflora, i, 6, p. 789), measuring 20 to 55 by 2 to 4 μ. The presence of a layer of cork cells between the healthy and diseased tissue is frequently observed. Infection is spread through the soil, and also carried by rain, wind, insects, and the like. The transmission of the disease from the bulb to the foliage has not been observed. The fungus overwinters on infected parts of the host in the open, on the bulbs in storage, and in the soil, where it is said to persist for at least four years without its host.

Among the most susceptible varieties in Germany are those belonging to the *gandavensis* varieties, e.g., Dora Mayer and Herbstzauber, while most of the *primulinus* varieties are resistant. Löbner has stated (in correspondence) that the incidence of infection after the damp, cool summer of 1924 ranged from 50 per cent. on six varieties (including Dora Mayer and Lene Grätz, which were also heavily attacked in 1922) to 0 per cent. on *G. primulinus* and Prof. Pauer.

The disease appears to be fairly widespread in Germany, and is stated by Löbner to occur also in Holland. The fungus has further been reported, as the cause of a leaf spot, from Italy, Portugal, and Silesia, and causing both bulb and leaf diseases in the United States.

In addition to the disinfection of the bulbs with uspulun [loc. cit.], the writer recommends the adoption of sanitary measures, including choice of suitable situations (not damp or cold), plentiful applications of manure, and judicious crop rotation.

ŠVEC (F.). **Choroby a Škůdci Karafiátů.** [Diseases and pests of Carnations.]—*Ochrana Rostlin*, v, 3, pp. 37–41, 1925.

This is an enumeration, together with brief descriptions, of the chief diseases and pests that attack carnations both in the open and in greenhouses. In most cases appropriate control measures are also indicated. The paper was written in view of the present set-

back to th commercial culture of carnations, which formerly formed an important economic item in Klattan [Bohemia], owing to the ravages done by the already existing diseases and pests and by the continual appearance of new ones. The diseases mentioned appear all to be due to already known parasites of this host plant.

SIMONET. **Notes de pathologie végétale.** [Notes on plant pathology.]—*Journ. Soc. Nat. Hort. de France*, Sér. 4, xxvi, pp. 442–425, 1925.

The author's observations and studies summarized in this paper were made at the phytopathological laboratory of Messrs. Vilmorin-Andrieux at Verrières-le-Buisson (Seine-et-Oise) during the abnormally wet summer of 1925, when several diseases of horticultural plants, about which little is known in France, were found in the vicinity of Paris.

Bacterial leaf spot of delphiniums (*Bacterium delphinii*) caused the foliage to wither after flowering and led to losses, especially amongst plants grown for propagation. A bacterial disease of antirrhinums, apparently not previously recorded, caused characteristic small, round spots with a purple margin, especially on the leaves and stems of the dark red varieties. The causal organism is a rather long *Bacterium*. Antirrhinums were also attacked and rapidly killed by a form of wilting due to *Phyllosticta antirrhini* [see this *Review*, iv, p. 94], the pycnidia of which were found at the collar and base of the branches, frequently in conjunction with those of *Diplodina passerini*, which is thought to be a weak parasite. Germination of the spores of *P. antirrhini* is said to occur only at temperatures above 68° F. and in constant humidity, and this appeared to be confirmed by the restriction of the disease to glasshouse cultures, whereas *D. passerini* was found parasitizing plants out of doors.

Vine mildew (*Plasmopara viticola*) caused considerable damage to *Vitis coignetiae* and was found to a lesser extent on Virginia creeper (*Ampelopsis veitchii*) [*Parthenocissus tricuspidata*].

A drying up of the aerial portion of the stems of *Aconitum napellus* and other perennial species of this genus was associated with *Vermicularia dematium*, a fungus which is sometimes saprophytic but frequently parasitic. Infection occurs at the base of the stem, and probably comes from the soil.

An anthracnose of *Dianthus semperflorens* resembled that observed in 1922 on *D. caryophyllus* and attributed to *Vermicularia herbarum* [see this *Review*, ii, p. 370]. Acervuli with setae were found at the base of the leaves.

Pinus sabiniana was attacked by a fungus which caused the leaves and shoots to dry up. The disease was confined entirely to this pine even when planted amongst others. The fungus formed pycnidia which were identified as those of *Sphaeropsis pinastri*, a species reported on *P. sylvestris* in New Jersey.

Gladioli were affected by a disease caused by a *Sclerotium* which in some cases did serious damage. The leaves and inflorescences turned yellow and dried up. Numerous black sclerotia, about 0·5 mm. in diameter, were found on the underground parts of the diseased plants. In pure culture only sclerotia were formed.

Directions for spraying fruits in Illinois.—*Illinois Agric. Exper. Stat. Circ.* 277, 23 pp., 2 figs., 1 diag., 1 map, 1925. [Received January, 1926.]

This is an expanded revision of circular 266 of the same title [see this *Review*, ii, p. 453]. A list (admittedly incomplete) of manufacturers of insecticides and fungicides in the United States forms a useful supplement to this circular.

BROADFOOT (H.). **Control of black spot, Venturia inaequalis (Cke) Aderh.**—*Agric. Gaz. New South Wales*, xxxvi, 10, pp. 747–750, 1925.

Black spot [scab] of apples caused by *Venturia inaequalis* is stated to be of considerable economic importance in New South Wales, and measures for its control are discussed at some length. The recommendation to destroy all fallen leaves in the orchards, as the primary source of infection, is considered to be theoretically sound, but the only practical method of accomplishing this is, according to the author, to plough them under during the winter, and to suspend cultural operations until after the time when the trees are most susceptible to attack by the fungus. In the majority of the apple growing districts in New South Wales, where conditions are very favourable to the development of the disease, this method is not likely to interfere with the general health of the trees, and no difficulty is expected in working up the land afterwards, while a superficial hoeing of the soil in the meantime would be useful in keeping down the weeds.

A spraying schedule which has given good results in tests made by the Department of Agriculture, and which is being adopted by many local growers, consists of the application of Bordeaux mixture at the bud-greening stage, followed by an application of lime-sulphur at the pink bud and calyx stages, and of later applications of lime-sulphur if necessitated by the atmospheric conditions. Lime-sulphur throughout has also given good results, but the use of Bordeaux mixture when the fruit is forming is liable to lead to more or less severe russeting of the apples [see also this *Review*, v, p. 103].

SWINGLE (C. F.). **Burr-knot of Apple trees. Its relation to crown gall and to vegetative propagation.**—*Journ. of Heredity*, xvi, 9, pp. 313–320, 1 pl., 3 figs., 1925.

An account is given in this article of the occurrence on the stems of quite healthy apple trees of burr-knots—in reality dormant roots which can be made to sprout under suitable conditions—which have probably often been mistaken for crown gall or hairy root caused by *Bacterium tumefaciens*. The formation of these burrs has been found to be a strictly varietal character.

MARLOTH (R.). **I. Further investigations into the causes producing rosette of Apricot and Plum trees in the Wellington district.**—*Dept. Agric. S. Africa Science Bull.* 42, 23 pp., 9 pl., 2 diags., 1925.

The chlorotic condition affecting apricot and plum trees in the Wellington district of South Africa [see this *Review*, iv, p. 40] is

now termed 'rosette , on the analogy of the rosette disease of apple trees in America [see this *Review*, iii, p. 341] which is considered to be an allied disorder. Though chlorosis is generally associated with the disease, this is not invariably the case. It has also been established by further observations that the fungal mycelium and nematodes in the roots of some trees, mentioned in the previous report, are accidental and are not concerned in the causation of rosette. On the other hand, a serious gummosis of the roots is evidently associated with the disease, but whether as its primary cause or as a concomitant symptom has not been determined. Crown gall [*Bacterium tumefaciens*] was common in all affected orchards.

Sodium chloride (white alkali) was present in appreciable quantity in all the soils examined from diseased orchards, while only a trace was found in soil from a healthy orchard, and this was associated in the former case with a deficiency of phosphates.

Reference is made to the view expressed by I. de V. Malherbe (Klorose in 'n Wellington Boord, *Die Burger*, 11th March, 1924) that the disease is nothing but lime chlorosis, brought about by wrong fertilization, but the author's analyses show that some of the soils concerned are much poorer in lime than those of healthy orchards, and that all have an acid reaction (P_H 6·2 to 6·8).

Attempts to convey the disease by grafting failed, and it is considered that it is not due to an infective virus, but is largely due to unsuitable soil conditions.

The only methods which appear practicable for avoiding this condition consist in careful cultivation, fertilization, and drainage, the avoidance of sites characterized by poverty of soil and absence of humus when laying out the orchards, and the use of varieties as stocks which are resistant to white alkali.

In a second part of the Bulletin [pp. 24–30] the suitability of peach stocks employed for apricot and plum trees on alkali soils is discussed and some preliminary experiments with them described.

SWARTWOUT (H. G.). **Blackberry, Raspberry and Dewberry culture.**—*Missouri Agric. Exper. Stat. Bull.* 231, 24 pp., 11 figs., 1925.

Brief notes on the following diseases of blackberries, raspberries, and dewberries [*Rubus* spp.], and their control, are given on pp. 22–24; crown gall [*Bacterium tumefaciens*]; anthracnose [*Plectodiscella veneta*]; and orange rust [*Gymnoconia interstitialis* and *Kunkelia nitens*].

SWARTWOUT (H. G.). **Gooseberries and Currants.**—*Missouri Agric. Exper. Stat. Bull.* 232, 12 pp., 5 figs., 1925.

Brief notes on the following diseases of gooseberries and currants, and their control, are given on pp. 11–12: anthracnose [*Pseudopeziza ribis*]; leaf spot [? *Mycosphaerella grossulariae* and *Cercospora angulata*]; and powdery mildew [*Sphaerotheca mors-uvae*].

JØRSTAD (I.). **Sprøiteforsøk mot Stikkelsbærdreperen.** [Spraying experiments against Gooseberry mildew.]—Reprinted from *Havedyrkningens Venners Medlemsskr.*, 2, 6 pp., 1925.

The results of three years' experiments in the control of goose-

berry mildew [*Sphaerotheca mors-uvae*] in different parts of Norway indicate that the following treatment is effectual. Spraying immediately before the opening of the buds with 4 per cent. common salt (to which 0·5 kg. of lime per 100 l. of solution may be added), 2·5 per cent. formalin, strong lime-sulphur, or 3 per cent. copper sulphate. This application may be omitted in mild cases. Just after the buds open and again a fortnight later, lime-sulphur (at half or full summer strength), 2 per cent. common salt, or 1 per cent. formalin should be applied. Lime-sulphur is stated to be the most reliable of all the preparations recommended. Directions are given for general sanitation.

GODDARD (E. J.). **Bunchy top of Bananas.**—*Fruit World of Australasia*, xxvi, 12, pp. 519–522, 1925.

In this report the author states that the transmission of bunchy top disease of bananas [see this *Review*, v, p. 110] by means of aphids (*Pentalonia nigronervosa*) has recently been definitely established. Experiments with 40 healthy plants from Bribie Island [Queensland] were made under greenhouse conditions. In the case of one set of 20 plants, divided from the other set by insect-proof sections, aphids from infected plants were transferred to the individual healthy plants growing in tubs, and every plant developed the symptoms of bunchy top within less than a month. The other set of twenty plants, without aphids, remained free from attack.

P. nigronervosa is widespread in the banana plantations of northern Queensland where, as yet, no bunchy top has been reported and there are, therefore, good grounds for assuming that in the affected areas of northern New South Wales and south-eastern Queensland the insect is carrying some infectious virus. The phloem of diseased plants has been found to show a very interesting and unique pathological condition affecting the sieve-tubes, which will be described elsewhere. That the disease belongs to the group of infectious virus diseases that are only transmitted by insects and by grafting is thought to be probable from the failure to secure infection by sap injections. Its general symptoms [see this *Review*, iii, p. 527] are considered to harmonize with those that have been observed in other diseases of this class.

Control measures recommended are based on the methods of transmission now established. No hope is held out that resistant varieties of bananas will become available in the near future. The removal and destruction of diseased stools immediately after detection, after thorough spraying with black leaf 40 to destroy the aphids on them, is considered practicable in lightly affected areas. Replanting is not recommended, as it is not yet known whether this practice is safe in view of the fact that the aphids may persist in the soil. All new plantings should only be done with suckers from areas in which the disease is not known to occur, and at least a weekly examination should be made of every plant in order to detect the earliest signs of attack. The possibility of controlling the aphid infestation by spraying and dusting demands further investigation. On certain plantations spraying with black leaf 40 is said to have proved fairly effective. Special attention is directed

to the necessity of taking every possible measure to protect the uninfected areas from the introduction of the disease, which is most likely to occur from the use of suckers from an infected area.

BENSON (A. H.). **Leaf spot on Bananas.**—*Queensland Agric. Journ.*, xxiv, 4, pp. 392–393, 1925.

It is stated that a leaf spot disease of bananas made its appearance in many parts of the coastal districts of Queensland towards the end of the summer of 1924–5 and continued to spread during the autumn. The oldest leaves were the first to be attacked, and in severe cases the whole of the leaves were destroyed, leaving only the bare pseudostem with the bunch entirely unprotected. If this happens when the bunch is immature the fruit remains undeveloped. On younger plants the damage is usually less marked, and the affected plants may recover and bear a marketable bunch of small fruit.

The trouble, which is said to be due to a microscopic fungus closely related to that which causes the shot hole disease of stone fruits [several different fungi are reported to cause shot hole in Australia], is evidently of a purely seasonal nature. Plants that were badly affected produced new leaves with no signs of leaf spot in the following spring (October 1925). Growers are recommended, however, to keep a careful watch for the reappearance of the disease when conditions again become favourable for fungus development. The application of a copper-lime dust by means of a dust gun as soon as the first spots are seen is recommended as a preventive measure.

MANUEL (H. L.). **Use of spreaders with Bordeaux mixture.**—*Agric. Gaz. New South Wales*, xxxvi, 10, p. 702, 1925.

The results of experiments made under departmental control during two seasons at Glenfield, New South Wales, indicate that casein and resin fish-oil soap are of approximately the same efficacy as spreaders when added to Bordeaux mixture. In New South Wales casein is cheaper, being a little less than half the cost of the resin fish-oil soap, but the latter is easily emulsified, and is worthy of being given a trial by growers.

WILLAUME (F.). **Esquisse d'un plan de sélection rationnelle des produits insecticides et fongicides commerciaux.** [Outline of a plan to enable a rational selection of commercial insecticides and fungicides to be made.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 3, pp. 207–224, 1925.

The author briefly reviews existing French and foreign legislation directed or applicable to the suppression of fraudulent or incorrect specification of commercial insecticides and fungicides, and recommends a policy of guaranteed composition controlled by the State through official analysis. In the case of secret preparations the method in use in the pharmaceutical trade, where the composition of a preparation may be concealed on payment of a supplementary tax, is suggested.

Deugdelijke middelen tegen plantenziekten en schadelijke dieren in den tuinbouw. [Efficacious methods of controlling plant diseases and insect pests in horticulture.]—*Versl. en Meded. Plantenziektenkundigen Dienst te Wageningen*, 43, 16 pp., 1925.

Brief notes are given on the composition and application of the principal sprays, dusts, fumigants, seed and soil disinfectants, and miscellaneous preparations (including a number of proprietary articles) used in the control of fungous diseases and insect pests. This subject has been dealt with more fully in a previous publication from the same source [see this *Review*, iii, p. 591].

PLAUT (M.). **Die Wirkung von warmen Beizmitteln und Vers che zur Stimulation.** [The action of hot disinfectants and experiments in stimulation.]—*Angew. Bot.*, vii, 3, pp. 153–184, 1 graph, 1925.

During 1919 and 1921 to 1924 an extensive series of field experiments was conducted to elucidate the following problems in connexion with the use of fungicides: influence of acid and alkali concentrations; effect of mechanical motion in disinfection; use of gases and stimulatory preparations; influence of heat on various fungicides; and parallelism between disinfectants, preservatives, and fungicides (not yet completed). The work of previous investigators is briefly discussed under each of these headings.

The effect of 30 minutes' immersion, with or without subsequent rinsing, in varying concentrations of acids and alkalis, was tested on spring wheat artificially infected with bunt [*Tilletia tritici* and *T. levis*] spores. Infection percentages ranging from 12·3 to 67·9 were obtained from untreated seed, thus disposing of the objection that spring wheat is unsuitable for experimental work by reason of its relative resistance. Complete control was given by n/1 solutions of sulphuric acid, with and without rinsing, and by the n/2 solution without rinsing, but germination was reduced from 97 to 33, 27, and 37 per cent., respectively. In the case of hydrochloric acid, control was secured by the n/1 solution with rinsing and the n/5 and n/10 solutions without it; germination was reduced to 38, 61·5, and 89 per cent., respectively. The percentage of infection was reduced from 34·3 (average of two plots) to 1·04 by treatment with 1 per cent. acetic acid. The n/1, n/2, and n/5 caustic potash solutions were effective when followed by rinsing; germination was entirely inhibited by the n/1 and n/2 solutions without rinsing and greatly reduced by n/5 and n/10. The n/1 caustic soda solution completely controlled the disease but reduced germination to 19 per cent. Preliminary experiments with chromic and chromacetic acid gave promising results in the control of both bunt and loose smut of oats (*Ustilago avenae*). Acid sodium sulphate and soda were ineffectual at all the concentrations tested; the latter produced no injurious effect on germination up to a strength of 35 per cent.

The percentage of infection in winter wheat was reduced from 14·34 to 0·33 by ten minutes' washing by exposure to a water jet (Jäger-Dix apparatus). In an experiment with summer wheat, the incidence of bunt was reduced from 67·9 to 2·38, 0·14, and 0·11 per cent. by 1½ hours' immersion in water (44° to 46° and 48° to 50°C.)

and 0·1 per cent. germisan (48° to 50°), respectively, when followed by rinsing, the corresponding figures without rinsing being 10·6, 3·5, and 0·99 per cent.

Complete control of bunt in winter wheat was obtained by one hour's exposure to the vapour of carbolic acid and six hours' exposure to mercury vapour. This treatment was quite inadequate against stripe disease and covered smut of barley (*Helminthosporium gramineum* and *Ustilago hordei*).

In 1923 and 1924 the stimulatory action of various preparations was tested on sugar beets. In the former year a slight increase in the sugar content of beets treated with betanal or germisan was observed. None of the preparations tested in 1924 gave adequate control of root rot [*Phoma betae, Pythium de Baryanum,* and *Aphanomyces levis*], or increase in sugar content or yield.

A slight increase in the yield of summer wheat was obtained by a combined germisan and hot water treatment. The other preparations tested (including uspulun and tillantin for oats and the latter only for wheat) failed to effect any improvement in the stand. The writer is, therefore, sceptical as to the value of the so-called stimulatory preparations.

Experiments have been conducted since 1920 to test the possibility of reducing the effective strength of disinfectant solutions by raising them to higher temperatures [see above, p. 154]. In 1923 one hour's immersion in cold solutions of 0·05 to 0·25 per cent. AZ3 (Saccharinfabrik, Magdeburg), and 0·2 per cent. tillantin C completely controlled stripe disease of barley, while the same results were obtained with 0·025 per cent. AZ3, and 0·1 per cent. tillantin C at 40° to 42° C.

A test was conducted to ascertain the effect of the repeated use of the same solution of 0·35 per cent. uspulun in the control of bunt, the original quantity of 4,500 l. being replenished each time by the addition of 1,000 l. of a 0·35 per cent. solution. From the first to the fourth repetition infection was completely prevented, while at the fifth and sixth a trace of bunt was observed.

BEIN (S.). **Das Verhalten quecksilberhaltiger Saatgutbeizen.** [The behaviour of mercury-containing seed disinfectants.]—*Chem. Zeit.*, xlix, 78, p. 537, 1925.

The results of the author's experiments, which are briefly described, indicate the importance of keeping fungicidal preparations containing mercury in hermetically sealed tin containers, which are stated to be highly resistant to any corrosive action. Both germisan and uspulun were found to be appreciably hygroscopic.

BAEHR (U.). **Beizversuche.** [Disinfection experiments.]—*Gartenwelt*, xxix, 43, pp. 720–722, 3 figs., 1925.

The writer conducted a series of experiments in the disinfection of various seeds with uspulun dust and (in some cases) with the 0·25 per cent. solution (one hour's immersion). The germination of Tuckswood tomatoes was delayed by these treatments [see also this *Review*, iv, p. 584], but in every case the seedlings recovered from this initial retardation in a month and were free from disease as compared with 12 per cent. diseased in the control.

With petunias the untreated seedlings were so heavily attacked by the 'propagation fungus' [*Moniliopsis aderholdi*] that 50 per cent. had to be discarded, while the treated plots remained healthy, though their germination was delayed.

A marked stimulus to the germination of different varieties of cabbage was given by both forms of treatment, especially dusting. The germination of the untreated seed and the subsequent development of the seedlings was considerably slower than that in the treated plots. In the writer's experience crucifers have uniformly reacted very satisfactorily to stimulatory treatment.

VAUPEL (O.). **Drei Jahre Trockenbeizung in Ungarn.** [Three years' seed dusting in Hungary.]—*Deutsche Landw. Presse*, lii, 41, p. 486, 3 figs., 1925.

The results of three years' experiments in the use of porzol in Hungary are briefly described [see also this *Review*, v, p. 117].

In a laboratory test on the stimulation of sugar and fodder beet seed clusters by porzol-R, the following data were obtained. (1) Sugar beets: controls, 53·5 seedlings from 100 clusters in seven days; 1 kg. porzol-R per 100 kg., 79; and 4 kg. porzol-R per 100 kg., 169·5. (2) Fodder beets: controls, 114·5 seedlings from 100 clusters in 14 days; 3 kg. porzol-R per 100 kg., 167·5; 4 kg. porzol-R per 100 kg., 215. In another test the germination figures were as follows: (1) Carrots: untreated, 7 per cent.; porzol, 51 per cent. (2) Spinach: untreated, 39 per cent.; porzol, 60 per cent. (3) Onions: untreated, 61 per cent.; porzol, 74 per cent.

The following results were obtained in a recent test with winter wheat heavily infected with bunt [*Tilletia tritici* and *T. levis*] (200 gm. of spores per 100 kg.): controls, 17·37 per cent. infection; copper carbonate dust (40 per cent. copper), 2·44 per cent.; porzol at the rate of 200 gm. per doppelzentner [= nearly 2 cwt.], 0·56 per cent. At 300 or 400 gm. per doppelzentner, porzol completely eliminated every trace of infection.

Porzol is stated to be now in general use over an area of 500,000 hect. where the writer has made a number of observations. In almost every case the treated fields were virtually or entirely free from bunt. On the Archduke Frederick's seed selection farm, where all the valuable élite and rare foreign strains were treated exclusively with porzol, not a single bunted ear was observed. On another estate the plots treated with porzol showed only 0·1 to 0·2 per cent. of infection, compared with 1 per cent. or above on those treated with copper sulphate.

Experiments conducted under State supervision in Switzerland, Holland, Austria, and Denmark are said to have confirmed the efficacy of porzol. In Germany somewhat conflicting data have been obtained, satisfactory results being given at Hohenheim and Landsberg-an-der-Warthe, while the data from the State disinfection experiments were less favourable, possibly owing to the low concentration used or to variations in the soil conditions. The manufacture of porzol is to be undertaken in Germany.

Generally speaking, porzol can be satisfactorily applied with the ordinary wooden mixing-drums, to which a small motor engine may be attached to facilitate the operation. Greater efficiency is

ensured, however, by the use of an apparatus fitted with the necessary internal contrivances, e.g.. the Calkins improved wheat-treating machine (Calkins Machine Co., Spokane, Washington).

FISCHER (W. E.) & SCHARRER (K.). **Ein neues Verfahren der Saatgutbeize.** [A new method of seed treatment.]—*Illus. Landw. Zeit.*, xlv, 43, p. 531, 4 figs., 1925.

In connexion with their new method of seed treatment, which has already been noticed from another source [see this *Review*, v, p. 117], the writers briefly describe an experiment in which rye seed-grain heavily infected by *Fusarium* [*Calonectria graminicola*] was immersed (*a*) in a well-known fungicide at the prescribed strength and duration; and (*b*) in the same preparation combined with trichlorethylene and carbon tetrachloride, which are stated to be suitable for use in conjunction with most of the recognized preparations on the market. While a considerable percentage of lot (*a*) showed fungous and bacterial infection, there was no trace of any contamination in (*b*). Excellent results were also obtained by similar treatment of flax seed, which was absolutely dry within a few minutes of removal from the disinfectant, even after 24 hours' immersion.

COOK (M. T.). **Esterilización de terreno para semilleros.** [Soil sterilization of seed-beds.]—*Rev. de Agric. Puerto Rico*, xv, 5, pp. 239–240, 1925.

The author discusses the factors promoting fungous infestation of seed-beds and emphasizes the importance of soil sterilization prior to sowing. On soil rich in humus-forming plant débris, diseases of seedlings of tobacco and other crops caused by fungi belonging to the genera *Pythium*, *Phytophthora*, *Rhizoctonia*, and *Fusarium* have frequently been observed in Porto Rico. The precautions recommended are considered to be especially necessary in the case of tobacco seed-beds in view of the fact that the conditions of atmospheric humidity and soil temperature favourable to the growth of this crop correspond to those which encourage fungus development.

A hot water treatment suitable for seed frames, and the method of sterilization by formalin, are described in detail. Steam sterilization is considered impracticable in Porto Rico.

FERRARIS (T.). **Trattato di patologia e terapia vegetale ad uso delle scuole di agricoltura.** [Treatise on vegetable pathology and therapy for the use of agricultural schools.]—3rd, completely revised, Ed., vol. i, xiv+635 pp., 135 figs., Milan, Ulrico Hoepli, 1926.

The third edition of Ferraris's well-known work, *I parassiti vegetali delle piante coltivate od utili* (a title still kept as an alternative one on the title-page), will be welcomed by all plant pathologists familiar with the earlier editions, as it maintains the fullness of treatment of particular diseases which was one of their marked features, while the contents are brought more up to date. The work has been divided into two volumes on account of the increase in its size consequent on the numerous additions that have been

made. The first volume, all published at the time of writing, contains a general section of 76 pages, comprising a short historical survey; an account of the nature, cause, spread, and effects of diseases; a discussion of the conditions favouring attack and of immunity; and the general principles applied in the control of plant diseases. This is followed by an illustrated account in greater or less detail, according to relative importance and the amount of knowledge available in Italy, of the plant diseases caused by the myxomycetes, bacteria, phycomycetes, and pyrenomycetes, each section being provided with a bibliography.

As is, perhaps, natural, diseases familiar to Italian workers are more fully and accurately treated than those that are of little importance or not yet recorded in Italy. Thus, while 42 pages are devoted to the vine mildew caused by *Plasmopara viticola* and 12 to the ink disease of chestnuts (*Blepharospora cambivora*), little over a page is given to common scab of potatoes, which is attributed to *Bacterium solani* Bolley. Nevertheless, in spite of its weak spots, the work contains by far the fullest treatment of the plant diseases of southern Europe and is a useful addition to any library of general plant pathology.

ZAPROMETOFF (N. G.). Болезни культурных растений в Средней Азии. [Diseases of cultivated plants in Middle Asia.]—165 pp., 80 figs., Uzbekistan Plant Protection Stat., Phytopath. Sect., Tashkent, 1925.

The introductory chapters of this text-book, intended for the students of the local plant protection stations, give a brief outline of the elements of general phytopathology and mycology, with a special section on control measures, insecticides, fungicides, and the like, after which brief descriptions are given in popular language of the principal diseases, both physiological and parasitic, that attack the crops cultivated in Middle Asia [the territory extending from the Caspian Sea and the Persian frontier eastwards to China]. The diseases are classed by their hosts, which are grouped under the headings: field crops (cereals and cotton); forage crops; market garden crops (including potatoes); miscellaneous economic crops (opium poppy, hops, sunflower [an important item, extensively cultivated for the seeds, which are used as human food and for the extraction of a comestible oil], tobacco, flax, &c.); fruit trees; berries; the grape vine; and miscellaneous trees.

Among the cereal smuts special mention is made of *Tilletia tritici* and *T. levis* as being, particularly the latter, the most widespread and destructive diseases of wheat. Besides *T. secalis* and *Urocystis occulta* on rye, the latter was found to be attacked in 1924 in the neighbourhood of Tashkent by a new smut, which was described by Jaczewski [source not indicated] as *Ustilago vavilovi* n. sp.; according to Jaczewski's description this species appears to stand, both morphologically and biologically, very close to *U. jensenii* [*U. hordei*]. So far it has been found only sporadically. Among the other cereal smuts of interest are *U. neglecta* [? *U. crameri*] on *Setaria italica*; *U. zeae* and *U. reiliana* [*Sorosporium reilianum*] on maize; while sorghum is attacked by *U.* [*Sphacelotheca*] *cruenta*, *Sorosporium reilianum*, and *S. ehrenbergii* Kühn. The latter

forms on the inflorescences fairly large (1 by 0·25 to 0·5 cm.), scattered, ellipsoidal sori, covered by a yellowish-white membrane and containing a black, granular powder composed of oval or somewhat angular, olive-green spores, from 9·2 to 11·5 μ in diameter, united into small masses which are difficult to break up.

In certain years cotton seedlings suffer fairly severely from attacks of a wilt which is attributed to *Nectriella* (*Neocosmospora*) *vasinfecta*. The seedlings are attacked in the spring, when from 15 to 20 cm. in height, and are rapidly killed by the mycelium of the fungus, which clogs the vascular bundles and interferes with the water supply of the plant. Generally the infected seedlings show a swelling at the base of their stem, together with an oblong, brown canker, which in wet weather turns pink. Inside the host tissues the fungus produces hyaline, ellipsoid, usually one-celled microconidia, while on the free surface of the dead tissues are formed hyaline, falcate, 3- to 5-celled macroconidia of the *Fusarium* type. Besides these two forms of spores, chlamydospores are also occasionally produced. The perithecia of the fungus are found on the roots and underground portion of the stem. A similar disease also occurs on *Sesamum orientale*, and is attributed to the same fungus.

Tomatoes are attacked by *Septoria lycopersici*.

Olpidium brassicae causes a wilt, locally known under the name of black leg, of cabbage seedlings. *Fusarium betae* causes a wet rot of the roots of beet. Cucurbitaceae are heavily attacked by mildew (*Sphaerotheca humuli*), particularly in the vicinity of rice fields. Opium poppy in the Semiretchensk region is frequently attacked by *Erysiphe cichoracearum*.

Clasterosporium carpophilum occurs on the apricot, peach, cherry (*Prunus cerasus* and *P. avium*), plum, and almond, and *Podosphaera oxyacanthae* on the quince and cherry trees. Both *Sclerotinia cinerea* and *S. fructigena* are recorded on *Prunus avium* and the plum.

The chief vine diseases are: *Oidium* (*Uncinula spiralis*) [*U. necator*], spotted anthracnose (*Gloeosporium ampelophagum*), *Cercospora vitis*, *C. roesleri*, *C. vitiphylla* Barb., and *Guignardia bidwellii*.

Howitt (J. E.). **A review of our knowledge concerning immunity and resistance in plants.**—*Sixteenth Ann. Rept. Quebec Soc. Prot. Plants, 1923–1924*, pp. 9–24. [Received 1925.]

A brief survey is made of some of the more important investigations in regard to the production of disease-resistant plants, and the nature of immunity and resistance is considered from the standpoint of the morphological and anatomical characters of the host and the biological relations between host and parasite. It is pointed out that cases of immunity or resistance may be due to the failure of the organism to accomplish either the first (penetration) or the second (the establishment of parasitism) stages of infection, the former being comparatively frequently due to the anatomical characters of the host tissue, cases illustrating which are cited. Even the second stage of infection is sometimes influenced by anatomical characters, but it is more frequently governed by the

biochemical properties of the cells. In regard to the latter, little of a precise nature is known, but all observations support the general proposition that immunity of this kind is owing to a definite antagonistic chemical inter-action between host and parasite.

While substantial and permanent progress has been made in the production of resistant varieties of plants, further and more extensive studies concerning the existence of biological strains of parasitic fungi are needed: the knowledge of biochemical causes of resistance is still fragmentary, and this offers the most promising field for future research.

A bibliography of 213 titles is appended.

COSTANTIN (J.). **Deux stations expérimentales nouvelles de l'argouane (Pleurotus eryngii).** [Two new experimental stations of the 'argouane' (*Pleurotus eryngii*).]—*Comptes Rendus Acad. des Sciences*, clxxxi, 15, pp. 447–449, 1925.

The author briefly describes two partially successful attempts to create new stations of *Pleurotus eryngii* [see this *Review*, iii, pp. 536, 537; iv, p. 194], an edible fungus locally known under the name 'argouane', by inoculating the soil around the living roots of *Eryngium campestre* with mycelium of the fungus. In neither of the two widely separated localities, namely, in the Ardennes and in the Forest of Fontainebleau, had the fungus ever been recorded before. A few well-developed fructifications appeared some months later on dead rootstocks of the host, which fact would apparently tell in favour of the saprophytic character of the organism. A further, unsuccessful, attempt by the author to cultivate it in a bed prepared of dead and decomposed stems and leaves of *E. campestre* does not, however, support this view, and he inclines to believe that the presence of living roots of the host is a necessary condition for the establishment of the fungus in the inoculated soil.

COSTANTIN (J.). **Un cas insoupçonné de pathologie végétale.** [An unsuspected case of plant pathology.]—*Comptes Rendus Acad. des Sciences*, clxxxi, 16, pp. 485–488, 1925.

In continuation of his previous note [see above abstract] the author gives a brief description of a series of experiments in which the soil of five large pots containing vigorous seedlings of *Eryngium campestre* was inoculated with mycelium of *Pleurotus eryngii*, while three pots were kept as controls. About 10 per cent. of the seedlings in the inoculated pots developed pathological symptoms on their underground parts; some of the tap roots were covered with an abundant white mould for a length of 2 to 8 cm., their cortical tissues were shrivelled, and the underlying wood was browned. When the point attacked was close to the collar, the aerial parts of the plant were killed, while the portion of the root below the infection continued living. In some cases the surface of the mouldy roots was cracked, the ensuing lesion taking the characters of an incipient canker, while in others the only apparent symptom was a slight browning and shrinking of the roots.

The author considers these results as definite proof of the parasitic nature of the fungus, which causes a mild type of disease, easy to

overlook in the field owing to the small percentage of plants attacked and the absence of outward symptoms on the aerial parts, thus justifying the term 'occult parasitism' which he used in 1923 in respect of this fungus. In another series of experiments with *Eryngium maritimum*, the results were still more convincing, as about 71 per cent. of the plants were killed, and it is suggested that this host is more susceptible than *E. campestre* to the attack of *P. eryngii.*

MULVANIA (M.). **A special application of collodion sacs.**—*Abs. of Bact.*, ix, 1, pp. 11–12, 1925.

This is an author's abstract of a paper read at the twenty-sixth annual meeting of the Society of American Bacteriologists on 30th December 1924.

A graded series of collodion sacs was made to determine the dialysability of the virus of mosaic disease of tobacco [see this *Review*, iv, p. 689]. It is argued that any body which can pass such sacs and retain its identity cannot be regarded as a living protoplasmic unit in the ordinary sense of the expression, since a living cell cannot be simpler than a formed protein mass.

Contrary to theoretical expectation, the results of the experiments denoted that the virus passes more easily through the sacs made from collodion dissolved in the higher ratio of ether to alcohol as a solvent.

SIMONET (M.). **Les champignons endophytes des Orchidées.** [The endophytic fungi of Orchids.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 3, pp. 204–206, 1925.

The author has isolated the endophytes of a number of orchid genera and grown them on various media, including bean meal. Two types were recognized, *Rhizoctonia repens* on *Cattleya*, *Laelia*, *Cypripedium*, *Serapias*, *Ophrys*, and *Orchis*, and *R. mucoroides* on *Vanda*, *Phalaenopsis*, and *Orchis montana*, which may also contain the former.

SAITO (K.). **Further notes on the enzymes of Monascus purpureus Went.**—*Bot. Mag.*, Tokyo, xxxix, 464, p. 224, 1925.

It has been found by the author, contrary to the results reported by Hagiwara and Aoyama [see this *Review*, iv, p. 629], that protease is formed in cultures of *Monascus purpureus* while invertase is absent. The experiments described are considered to show that the enzyme solution from this fungus does not decompose cane sugar into reducing sugars, and that the fungus is not capable of assimilating cane sugar. On the other hand, peptone, gelatine, and casein are decomposed by it.

SKINNER (C. E.). **What organisms are responsible for the decomposition of cellulose in the soil?**—*Abs. of Bact.*, ix, 1, p. 32, 1925.

This is an author's abstract of a paper read before the twenty-sixth annual meeting of the Society of American Bacteriologists on 31st December 1924.

Fungi are thought to be the most important agents in the decomposition of cellulose in the soil. The addition of finely powdered

filter paper to a soil causes an immense increase in the amount of fungous growth as determined by direct microscopic examination and plate counts, especially when sufficient available nitrogen is also added. Little or no increase in bacterial numbers is effected by the addition of cellulose. Pure cultures of fungi caused a much more complete and rapid decomposition of cellulose in sterilized fertile soil than did either crude or pure cultures of bacteria which were able to decompose cellulose in liquid media. Most of the pure cultures of fungi isolated from an active cellulose-decomposing soil decomposed cellulose as quickly as a soil inoculum.

There was little decomposition of cellulose when the fungi were eliminated by the carbon bisulphide treatment of basic or slightly acid soils, though the bacterial population was greatly increased. A reinoculation with soil of the partially sterilized soils was followed by a rapid increase in fungous growth, which was correlated with a rapid decomposition of cellulose. The addition of NO_3 stimulated both cellulose decomposition and the development of fungi, but had little effect on the bacteria.

Among the cellulose-decomposing organisms in the soil are species of *Fusarium*, *Trichoderma*, *Penicillium*, *Alternaria*, and others.

Coons (G. H.) & Klotz (L. J.). **The nitrogen constituents of Celery plants in health and disease.**—*Journ. Agric. Res.*, xxxi, 3, pp. 287–300, 1925.

The results of comparative chemical analyses of healthy and diseased celery leaves affected with two widely differing types of disease, namely, *Cercospora apii* and *Septoria apii*, indicate that in both cases there is a lower percentage of total nitrogen in the diseased than in the healthy tissue. A comparison of the nitrogenous compounds present showed a larger proportion of ammonia, humin, and protein, and a smaller of hydrolizable, acid amide, and non-protein nitrogen in the diseased tissue. Nitrites were present in the diseased tissues.

The fungi evidently use the nitrogenous compounds of the leaf tissues for nutritive purposes, and the results obtained are thought to be best interpreted from the point of view of the metabolism of fungi, the loss of nitrogen being similar to that which occurs when fungi are growing on an artificial medium. In fungus cultures the disappearance of the carbohydrate from the medium occurs simultaneously with the appearance of ammonia and with the beginnings of autolysis of the fungi. Ammonia appears to be the chief nitrogenous product of the splitting of the peptone of the medium in the absence of another carbon source necessary for metabolistic processes. In the presence of dextrose the ammonia is reassimilated.

The importance of the nitrogen metabolism of parasitic fungi is stressed as a possible explanation of selective parasitism and as a basis for studies in immunity.

Blattný (C.). **Mimořádné choroby a škůdcové Bramborů v r. 1925.** [Uncommon diseases and pests of Potatoes in 1925.]—*Ochrana Rostlin*, v, 4–5, pp. 74–76, 1 fig., 1925.

The year 1925 was marked in Czecho-Slovakia by heavy out-

breaks in the middle of August of late potato blight (*Phytophthora infestans*) which, in some districts, resulted in infestation of the tubers to a degree hitherto unrecorded in the country. The interesting observation was made by the author that, some three weeks after harvest, blight-infected, but outwardly sound and bacterium-free tubers of the Industry variety exhibited swollen eyes (germs), about 50 per cent. of which rapidly developed into daughter-tubers, while uninfected tubers from the same plants remained entirely normal. The latter fact indicates, in his opinion, a close connexion between the infestation of the tubers by *P. infestans* and the production of daughter-tubers [a process termed by the author 'rejuvenation' of the tubers]. He does not believe, however, that this phenomenon represents an effort on the part of the diseased tubers to protect themselves against the fungus.

Towards the end of July, particularly on heavy clay soils with an impervious subsoil, potatoes were attacked rather heavily by *Periola tomentosa* Fr., which formed on the tubers small, white, flaky warts. The sporodochia are of irregular shape, firmly adnate, and contain obovate, hyaline spores, 5 by 3 μ in diameter. By itself the disease does not cause any damage to the crop, but it is dangerous in that it may afford entrance to secondary organisms, especially to the wet rot bacteria. Varietal resistance to the fungus was noticeable, the main commercial varieties of potatoes, e. g., Wohltmann, being the most susceptible. Thorough drying of the tubers at harvest time should be sufficient to control this trouble, which should not be confused with the very similar symptoms that result from growth in waterlogged soils and consist of an enlargement of the lenticels, which are surrounded by a loose, white tissue, composed of cells frequently lying quite unattached to one another.

GILBERT (A. H.). **'Giant hill' Potatoes a dangerous source of seed. A new phase of spindle-tuber.**—*Vermont Agric. Exper. Stat. Bull.* 245, 16 pp., 6 figs., 1925.

An increasing prevalence of potato plants, especially of the Green Mountain variety, showing certain abnormal characters, e. g., large, coarse vines, late blossoming, and unusually large tubers, has recently been observed in Vermont. This condition is known locally as 'giant hills', and is considered by the author to be a degeneration disease similar in its effects upon tuber shape to spindle tuber [see this *Review*, iii, p. 296], but producing distinct symptoms on the foliage. The most conspicuous of these are a spreading habit of growth; rough, marginate stems; and erect, often rolled, rugose, or wavy leaves. The tubers are elongated, thickened, pointed at one or both ends, frequently constricted at some point on the longer axis, and having numerous eyes either flush with the surface or slightly protuberant. To a limited extent the type of spindle tuber described by Schultz and Folsom [loc. cit.] has also been found in Vermont, particularly in a strain of the Delaware variety. The tubers of such plants are smooth-skinned, elongated, with a cylindrical tendency, sometimes pointed at one end and constricted on the longer axis. The same control measures are applicable to both forms of the disease, namely, selection of healthy seed; separation of the seed field as far as possible from other potato fields; and

thorough roguing of the seed field throughout the growing season.

Delaware spindle tuber samples when grown the following year exhibited the typical symptoms of the disease, including retarded growth. The Pride of Vermont variety, of giant hill parentage, almost uniformly developed a single-stalked vine with somewhat conspicuous axillary shoots.

A brief general discussion of potato degeneration diseases is included in this paper.

COLLINS (E. J). **The physiological aspect of the incidence of late blight (Phytophthora infestans) of Potatoes.**—Abs. in *Proc. Linn. Soc., London, 137th Session, 1924–25*, pp. 11–12, 1925.

In this paper an account is given of investigations carried on at the John Innes Horticultural Institution into the causes of the seasonal occurrence of potato blight (*Phytophthora infestans*), incident to an attempt to produce a high-yielding, immune variety of potatoes.

The apparent correlation between resistance and time of maturity is thought to be closely connected with physiological changes which occur in the foliage as it approaches maturity. The results of experiments with early, mid-season, late, and very late varieties indicate that the water content of the foliage has a marked influence on the rate of growth, time of maturity, and yield, and that the early varieties, which have the highest water content, are the most susceptible to blight, while the most resistant, which are the latest to mature, have the lowest water content. It was found that the nitrogen content reaches a maximum and then falls more or less rapidly as the plant matures. With regard to the diurnal variation it was found that the water content was higher and the nitrogen content lower in the early morning than the previous evening.

The water to nitrogen ratio is, in general, highest at the time of seasonal infection, and the degree of susceptibility of a variety to blight is indicated more precisely by the value of this ratio than by that of the separate components. Young foliage has a lower water and higher nitrogen content than foliage of a medium age, while in old foliage the reverse conditions hold. These differences lessen as the season advances. In an attack early in the season the oldest foliage shows the first signs of infection, while a somewhat later attack will cause an epidemic. In the later phases of natural maturation the foliage becomes drier and the attack is less apparent.

The fact that sprayed foliage showed a lower water and a higher nitrogen content than unsprayed foliage indicates that there is a valuable physiological effect of spraying on the plant, quite apart from its fundamental value.

The conclusion is reached that high yield and high resistance to late blight represent the expression of the two extreme values of the same physiological complex, and hence the difficulty of producing a variety combining both characteristics, although the possibility of a combination of immunity due to the possession of a definite immunity factor and of high yield, in some new form or variety, is not considered to be excluded.

FOËX (E.). **La maladie verruqueuse de la Pomme de terre.** [The wart disease of Potato.]—*Journ. Soc. Nat. Hort. de France*, Sér. 4, xxvi, pp. 309–369, 1925.

In this paper the author reviews the introduction and spread of the wart disease of potatoes [*Synchytrium endobioticum*] in Great Britain and Ireland, Germany, Holland, Scandinavia, Poland, Czecho-Slovakia, the United States, and South Africa, and discusses in detail the symptoms, life-history and cytology, propagation, and methods of control (based largely on experiments conducted in England). A list is given of immune and resistant varieties in different countries, and a section is devoted to the legislative measures taken to prevent the importation and spread of the disease.

KÖCK (G.). **Der Kartoffelkrebs in Oesterreich.** [Potato wart in Austria.]—*Wiener Landw. Zeit.*, lxxv, 45, p. 377, 1925.

Wart disease of potatoes [*Synchytrium endobioticum*] was found in the Montafon valley of Vorarlberg during the harvesting operations in 1925, the affected area covering approximately 15 ares. The diseased plants were grown from apparently healthy Deodara seed from Stuttgart, which had given an excellent yield in 1924. Drastic measures were immediately taken to prevent the further spread of infection.

BAUNACKE. **Neue Kartoffelkrebsherde.** [New centres of Potato wart infection.]—*Die Kranke Pflanze*, ii, 11, p. 231, 1925.

The presence of wart disease of potatoes [*Synchytrium endobioticum*] is stated to have been notified from 64 fresh localities in Germany during 1925, bringing the total number of officially recognized infected areas up to 167.

HUNT (N. R.), O'DONNELL (F. G.), & MARSHALL (R. P.). **Steam and chemical soil disinfection with special reference to Potato wart.**—*Journ. Agric. Res.*, xxxi, 4, pp. 301–363, 2 pl., 3 figs., 1925.

In this paper the authors describe extensive investigations and experiments carried out at the Freeland field station, Pennsylvania, since 1919, with the object of testing soil disinfection as a means of eradicating potato wart disease (*Synchytrium endobioticum*).

Steam sterilization was tested by the inverted pan method, either alone or used in conjunction with chemical disinfection; chemicals alone were also tried. The first of these methods is slow, difficult to manipulate, and very expensive. The results also indicate that it is not dependable, since several of the plots exposed to steam at 90 to 95 lb. pressure for 85 minutes or more showed infection the following year. The combination of steam with small quantities of chemical disinfectants was unsatisfactory.

Of the 22 chemicals tried, 14 produced wart-free plots during the season treated and the two following seasons. Of these corrosive sublimate, chloride of lime, copper sulphate, sodium fluoride, and sulphur were used dry; kerosene and crude oil were used undiluted; whereas water was added to the rest, including Bordeaux mixture, formaldehyde, and lime-sulphur. Several of the treatments seriously impaired the growth of the crop, especially sodium fluoride (growth

entirely prevented) and sulphur (growth almost prevented). Corrosive sublimate, kerosene, and Bordeaux mixture permitted growth sufficiently for an adequate test of the behaviour of the plants to infection. The approximate cost per acre for the materials used in the successful treatments is given.

Observations as to the temperature changes occurring in soil under the steam pan treatment were based on the necessity of heating the topmost 8 inches of soil (below which wart spores have not been found) to approximately 100° C., which the experiments indicated was required to exterminate the organism. The shorter the steaming period, the longer the time required for penetration of heat into the soil. Variations in the rate of increase and decrease of temperature in the soil depend on the pressure of steam used, length of treatment, and the depth in the soil. Doubling the steam pressure almost doubles the rate of penetration of heat. The results of these experiments are given in tabular form.

The depth of penetration of various soil fungicides was also tested. The results showed that the penetration of formaldehyde in water solutions practically coincided with that of the water in the solution. The addition of sodium chloride to the mercuric chloride solution, at the rate of five parts of the former to one of the latter, facilitated penetration and was used in most of the experiments with this substance. The same was the case with copper sulphate. The percentage of moisture in the soil influenced the penetration of undiluted kerosene. The records as to the varying degree of penetration into loam and silt loam in different districts show that the percentage of soil moisture does not affect all chemicals alike.

A further series of experiments was carried out to test the effect of certain chemical treatments on potato growth, the results (given in tabular form) indicating that Bordeaux mixture (all concentrations), potassium permanganate in its higher dilution, and a proprietary compound called Qua-sul are apparently non-injurious to plant development. With certain other chemicals (chloride of lime, copper sulphate, lime-sulphur, &c.) growth is decidedly limited the first year, but in successive years the effect appears to pass off gradually. Sulphur was more injurious after the first year, a fact attributed to the increase in soil acidity beyond the limit of tolerance by potatoes, due to gradual oxidation. In applying a chemical for sterilization of the soil, consideration should, therefore, be given to the tolerance of the plant for the particular substance used, as well as to the rate of application and the prevailing soil and climatic conditions.

SCOTT (G. A.). **Cultural characteristics of certain Colletotrichum species.**—*Sixteenth Ann. Rept. Quebec Soc. Prot. Plants, 1923–1924*, pp. 123–137, 5 pl., 6 diags. [Received 1925.]

A full description is given of laboratory studies of the organisms responsible for the diseases of potatoes variously known as dartrose, black dot, &c. Six organisms were compared, namely: the organism isolated from Quebec material and its saltation [see this *Review*, v, p. 52]; *Vermicularia varians* of French origin; *Colletotrichum tabificum* from England; *C. atramentarium* from Ohio; and *C.*

atrovirens from West Virginia. These were grown on a large number of solid and liquid media. Observations as to type and rate of growth, nutrient requirements, hydrogen-ion reaction, morphological and physiological characteristics, and effect of temperature, light, and carbon dioxide [full details of which are given] have led to the conclusion that all these strains, with the exception of the saltation, are identical. The only differences in the saltation lay in the absence of sclerotia on artificial media and a slight variation in coloration. No pycnidia were produced in any of the cultures. Conidia were formed luxuriantly in all, and it appeared that each conidiophore always bears a conidium at its tip, while others are found lower down. After the first falls, others are developed in the same place. They are mostly 16·5 to 20·8 by 3 to 3·9 μ in diameter, and are cylindrical, sometimes slightly curved or constricted in the middle, slightly pointed at the base, and rounded at the free end. Setae were observed in all the strains at some time or other.

The work was done in B. T. Dickson's laboratory at Macdonald College, Quebec. [As already mentioned in this *Review*, v, p. 124, Dickson regards *C. atramentarium* as the correct name for the organism.]

Du Porte (E. M.). **A Preliminary note on some endophytic protozoa.**—*Sixteenth Ann. Rept. Quebec Soc. Prot. Plants, 1923–1924*, pp. 94–96. [Received 1925.]

The author has made a survey of the laticiferous plants near Macdonald College, Quebec, and found flagellates or amoebae constantly present in several.

Though *Leptomonas davidi* is said to be associated with a definite gummosis of *Euphorbia*, in none of the plants studied by the author have any disease symptoms been detected which are positively associated with the presence of protozoa. In most cases the plants may be extensively parasitized without showing any effects. The organisms apparently pass the winter as minute resting cells in the stems of shrubs or the roots of herbaceous perennials. Tropical plants in the greenhouse contain them in an active condition throughout the winter. A flagellate in *Asclepias syriaca* and an amoeba of *Convolvulus sepium* were observed to pass into the seed in the resting stage and later to infect the seedling.

Winkler (H.). **Die Schädlinge und Krankheiten des Reises.** [The pests and diseases of Rice.]—*Tropenpflanzer*, xxviii, 4, pp. 174–189; 5, pp. 242–255, 1925.

In the second part of this paper [the first part of which deals exclusively with insect pests], the following diseases of rice are briefly described, with references to the principal literature in each case. *Sclerotium oryzae* [see this *Review*, iii, p. 174]; *Ustilaginoidea virens* [see this *Review*, i, p. 158]; *Tilletia horrida*; *Sclerospora macrospora*; *Helminthosporium oryzae* [see this *Review*, ii, p. 230]; blast (*Piricularia oryzae*) [see this *Review*, i, p. 343]; and a number of fungous diseases of minor importance. In the section on non-parasitic diseases, a brief description of straighthead is given [see this *Review*, i, p. 83].

SOUTH (F. W.) & SHARPLES (A.). **The 'mouldy rot' disease of Hevea brasiliensis in Malaya.**—*Dept. Agric. Straits Settlements and Federated Malay States Bull.* 37, 31 pp., 3 pl., 1 map, 1925.

In this Bulletin a full account is given of the history, symptoms, methods of spread, and control of the mouldy rot disease of the bark of *Hevea* rubber, caused by the wound parasite *Sphaeronema fimbriatum* [see this *Review*, iv, pp. 633, 765].

The disease is only known in Malaya and Java up to the present and is believed by the authors to have been introduced in some way, possibly on some other imported host, to the locality in which it first appeared in 1916. Subsequent spread throughout the Peninsula is believed to have been entirely by human agency, chiefly by the migrations of tapping coolies. Since its first appearance the fungus, the life-history and morphology of which are briefly described, is thought to have increased in virulence, new infections producing a visible growth on the surface of the tapping cut, to which the attacks are practically restricted, in 5 days or less as against 10 to 12 days in the 1916–17 attacks.

In the control of the disease the best results have been obtained with a 20 per cent. solution of the proprietary fungicide agrisol, supplied by Messrs. Major & Co., Hull, England [see this *Review*, i, p. 329]. The authors' recommendations for the use of this preparation are as follows. (*a*) On badly infected areas. All trees under treatment must be treated at intervals of 12 days, healthy trees being painted with plain agrisol to which a red colouring matter has been added. Tapping should cease on the diseased trees. Treatment should be continued on the diseased trees as long as new cases continue to appear, but it is not necessary on subsequent rounds in the case of healthy trees. The ordinary tapping coolies can carry out the treatment. (*b*) In lightly infected areas. Special coolies should be trained as mouldy rot painters, and should inspect all the trees every 12 days (about 100 acres per coolie). On each round any diseased trees should be marked, put out of tapping, and painted with agrisol. After a month from the first treatment, trees that have had no recurrence of the disease can be tapped again. In estate practice in certain cases a 10 days' round has been found advantageous, and even in severely infected areas, special painting coolies are sometimes employed. The cost in an estate which kept careful records was $10\frac{1}{4}$ cents per acre per month, or \$1·26 (3 shillings) per acre per annum, and the result was to secure adequate control with no loss of bark. Complete eradication has, so far, proved impracticable. In certain estates knapsack sprayers are used instead of brushes to apply the disinfectant, various types of which are used [see this *Review*, iv, p. 766].

Details are given of the legislative measures taken to enforce treatment, of the staff employed, and of the methods made use of (including cinematograph displays) to secure an effective propaganda against the disease, especially amongst the native and Chinese smallholders.

BLATTNÝ (C.). **Poznámky k letošnímu zdravotnímu stavu Chmele.** [Notes on this year's health of the Hop crop.]—*Ochrana Rostlin*, v, 4–5, pp. 67–74, 2 figs., 1925.

In 1925 hops were comparatively free from fungal diseases in

Czecho-Slovakia, but small outbreaks of the following were recorded in some localities.

Septoria humuli West. caused rather serious damage in the middle of July in the provinces of Rakovnik and Rudnik, but ceased activity towards the end of July. The leaves on the bines were attacked up to a height of 2 to 3 m. from the soil, and were rapidly killed. In the same localities also the hops were mildly attacked by *Phyllosticta humuli* Sacc. & Speg. Somewhat more widespread were *Ascochyta humuli* Kab. & Bub. and *P. lupulina* Kab. & Bub., the symptoms of which are very similar. The majority of the infected leaves are noticeable by their dark green colouring, an indication of the accumulation in them of assimilation products, and by their curly appearance; they bear on the upper surface dot-like, papillate, white fructifications, which are scarce on the host in nature, but develop in very large numbers in saccharose cultures.

During the rainy period at the end of July and beginning of August a browning of the hop-cones was noticed in a few cases; the discoloration started from the top, and in a week extended over the whole of the cone, on which, particularly at the initial stage, numerous conidia of a species of *Cercospora* were found; the author does not believe, however, that this fungus is identical with *Cercospora cantuariensis* [see this *Review*, iii, p. 61]. Besides this species, on the brown and yellow cones were also found the fructifications of a species of *Macrosporium* identical with that described by Salmon and Wormald [see this *Review*, iii, p. 62], and of a *Pseudoperonospora*, which is believed to be identical with *P. humuli* [see this *Review*, v, p. 127].

Mosaic of hops has not been so far recorded in Czecho-Slovakia. A fairly serious outbreak of this disease, however, is reported from the province of Banat, Jugo-Slavia, and the prohibition of importation of hops from that country is advocated.

DUFFIELD (C. A. W.). **Nettlehead in Hops.**—*Ann. of Appl. Biol.*, xii, 4, pp. 536–543, 1925.

In this paper the author distinguishes two forms, 'true' and 'false', of the diseased condition of hops [*Humulus lupulus*] known as 'nettlehead' [see this *Review*, iv, p. 634], and describes the characters of both diseases.

The true form, which is the only one in which the leaves really become rather like those of the nettle [*Urtica dioica*], is confined to hills over three years old, and usually commences at the edge of a garden, especially where the land slopes downwards towards a stream or hedge. Pasture land put under hops also commonly shows the disease about the third year. The growth of affected plants is stunted in the majority of cases, but certain exceptions have been observed, in which growth continues normally for a time, after which it ceases and the leaves become 'nettly'. Sometimes only one bine is affected, the others remaining normal though liable to be all diseased the following year. The leaves are small, light in colour, and with semi-transparent yellowish streaks along the ribs. When these develop the bine ceases climbing and falls away from its support. The root system does not seem to be affected.

False nettlehead, on the other hand, affects both very young and older hills, and occurs throughout the entire garden. The bine does not become detached from its support, but ceases to grow in June and usually dies away in August. The roots decay and the disease appears to affect the whole plant. The leaves are considerably larger than in the case of the true form, and of a bluish colour; the internodes are shortened and give the plant a 'bunchy' appearance.

The losses caused by true nettlehead are very considerable in Kent, where false nettlehead is an equally serious disease. In Worcestershire the true form was chiefly observed.

Nettlehead was formerly attributed to an eelworm (*Heterodera schachtii*), but the author's observations indicate that this cannot be considered as the primary cause of the disease, although it is not uncommon in hop gardens under certain conditions. It has been noticed that true nettlehead is much in evidence the year following a severe aphis attack.

DUCOMET (V.). **Le mildiou du Houblon, maladie nouvelle pour la France.** [Hop mildew, a new disease in France.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 3, pp. 248–254, 1925.

The downy mildew (*Pseudoperonospora humuli*) was observed by the author on wild and cultivated hops growing at Grignon in May 1925, and has subsequently been found in various places in Seine-et-Marne, Seine-et-Oise, Aisne, and the Côte-d'Or [France].

The symptoms are briefly described with special reference to the researches of Salmon and Ware [see this *Review*, iv, p. 702]. The author finds it difficult to accept the hypothesis of these authors that the disease is a form of the downy mildew of the nettle, the latter being, in his opinion, due to a distinct species, *P. urticae*, having a more greyish-lilac colour, with paler conidia, the ratio of length to breadth in which is 1·4 against 1·6 in *P. humuli*, while the total length is on an average 1·15 times greater in *P. humuli* than in *P. urticae*. All the facts are thought to indicate that the hop disease is a recent introduction to France, not extending beyond a few years. Hibernation of the mycelium in the root stock is not thought probable. For control the author suggests, besides the growing of resistant varieties (search for which should be made), spraying with a fungicide and the removal of all infected shoots, followed by a second spraying. After cutting back in the autumn, the plants may be cleaned up by a spray of 10 to 15 per cent. sulphuric acid.

Verslagen, 5e Aflevering. Verslagen der Vergaderingen van de Vereeniging van Adviseurs bij de Java-Suikerindustrie. Verslag der Vergadering van de Landbouwkundige Sectie op Woensdag, 5 Augustus 1925. [Reports, 5th series. Report of the meetings of the Association of Advisers to the Java Sugar Industry. Report of the meeting of the Agricultural Section on Wednesday, 5th August 1925.]—*Arch. Suikerind. Nederl.-Indië*, xxxiii, 4, pp. 189–244, 1925.

Among the subjects discussed at this meeting were the following relating to diseases of sugar-cane. Sereh disease [see this *Review*,

iii, p. 554] is stated to be increasing to an alarming extent in the nursery gardens of the Malang plateau.

Mosaic [the chief points in connexion with which are summarized] was not severe, in the 1924–5 season, in gardens planted in November, while in the previous year the critical month for planting was December. These dates coincide with the emergence of *Aphis adusta* [*A. maidis*]. The postponement of planting till January resulted in complete freedom from mosaic.

The results of investigations conducted by the Cheribon sub-section in 1924 indicated the occurrence of three distinct types of root rot [see this *Review*, iii, p. 237, v, p. 57], associated with (1) excessive soil moisture; (2) the presence of a fungus in the vascular bundles of the canes; and (3) soil infection, which consistently produces the disease in the EK28 variety but not in EK2.

Wilt disease was more prevalent in Cheribon in 1924–5 than in the preceding year. The cause of this disturbance is still obscure.

The application of the hot water treatment on a large scale for the control of sereh disease [see this *Review*, v, p. 4] was also discussed.

COOK (M. T.). **Sugar production and Cane diseases.**—*Facts about Sugar*, xx, 45, pp. 1068–1069, 1925.

A brief popular account is given of the principal diseases of sugar-cane in Porto Rico, the economic importance of which is thought to be inadequately realized. Statistics are given of the losses from mosaic disease in various parts of the Island during the period 1915 to 1919, the lowest record occurring in Mercedita-Providencia (10·8 per cent.) and the highest in Cayey (50 per cent.).

Rapport de l'Entomologiste et Phytopathologiste. Insectes et Maladies. [Report of the Entomologist and Phytopathologist. Insects and Diseases.]—*Septième Rapport Stat. Agron. Guadeloupe, 1924–1925*, pp. 30, 30 bis, 30 ter, 1925.

It is stated that Guadeloupe suffers exceptionally little from sugar-cane diseases, and even those present are less severe than elsewhere. Thus, although red rot (*Colletotrichum falcatum*) is found on many canes, no difference in vigour can be observed between these and healthy canes. *Melanconium sacchari*, which causes little pustules on the epidermis near the nodes, is common, and is believed to hinder the growth of cuttings if weather conditions are unfavourable. This disease is also found on over-ripe or dried canes, but neither this nor red rot is considered sufficiently important to require extensive control measures, though care should be taken to prevent too great an accumulation of the latter.

The treatment of cuttings with Bordeaux mixture is recommende as a safeguard against the spread of diseases and an aid to germination.

COTTRELL-DORMER (W.). **Bureau of Sugar Experiment Stations. Investigations of pests and diseases.**—*Queensland Agric. Journ.*, xxiv, 4, p. 336, 1925.

This report, dated 22nd September 1925, is in continuation of the series previously noticed [see this *Review*, v, p. 4].

The occurrence of gumming disease [*Bacterium vascularum*] in the Aloomba locality has been confirmed, and this should now be regarded as a quarantined area. The planting of resistant varieties, such as Badila, B 147, and Q 813, is recommended. The B 147, however, is very susceptible to the leaf stripe disease [*Sclerospora sacchari*] and requires selection for health before introducing into districts hitherto free from this disease.

Somewhat severe damage has been caused by leaf scald [*Bacterium* sp.] in certain areas, especially in Clark's seedling, Pompey, NG 24B, H 109, and Badila cane. It was observed that in attacked plants of HQ 426, 7 R 428, and H 109, the stools died off very suddenly, frequently without any formation of the side shoots that are normally characteristic of this disease.

STOREY (H. H.). **The transmission of streak disease of Maize by the leafhopper Balclutha mbila Naude.**—*Ann. of Appl. Biol.*, xii, 4, pp. 422–439, 3 pl., 1925.

In this paper the evidence on which is based the conclusion that streak disease of maize is transmitted by the jassid *Balclutha mbila* [see this *Review*, v, p. 2] is given in detail. Other diseases of the virus type which can be transmitted by this group of insects are stated to be few and to include the curly top of sugar beet caused by *Eutettix tenella*, aster yellows by *Cicadula sex-notata*, and potato leaf roll by *Typhlocyba ulmi* [see this *Review*, iii, p. 161].

An account is given of the development of the disease in maize, in which it is shown to be apparently not transmitted by the seed but to arise as a result of infection taking place at some stage subsequent to exposure of the aerial parts of the plant. Earlier experiments had shown that maize raised in insect-proof cages remained free from the disease. Further tests with plants raised in wire-gauze cages of different sized mesh showed that, with wire having 16 meshes to the inch, plants become infected, and individuals of *B. mbila* were the only suctorial insects found in the cages. The plants were entirely protected from infection in the cages with 32 and 52 meshes to the inch.

In a series of experiments the ability of the jassid leafhopper to transmit the disease from infected to healthy plants was clearly demonstrated. In four cages out of five, to each of which were introduced a few jassids from diseased maize, every plant became diseased. In three similar control cages there was no disease. Further tests were made with single insects enclosed in a glass tube into which a leaf of the plant was passed through a plug of cotton wool. Individuals collected from streak-diseased maize conveyed infection to 46 out of 48 healthy plants on which they were thus placed. No loss of the power of infection occurred in any jassid tested, in spite of periods of starvation or of feeding on apparently immune plants. One jassid lived for five months and infected eight separate plants. There were a few exceptions in which insects from streaked maize caused no infection under similar conditions. No infection was transmitted by jassids reared from healthy maize, but after feeding upon a diseased leaf for a week the percentage of infection was very high. Negative results were

obtained in trials of other jassids and of *Aphis maidis* and *Peregrinus maidis*.

DODDS (H. H.). **Report of Director of Experiment Station, South African Sugar Association, for October and November, 1925.** —*S. African Sugar Journ.*, ix, 11, pp. 753–757, 1925.

The first series of experiments on the effect of streak disease on sugar-cane in the field was conducted with cane planted in March 1924 and harvested in October 1925. The results showed an average loss in the plots planted with cane suffering from streak, as compared with healthy cane, of 10·9 per cent. in weight per acre of cane, in spite of the fact that the healthy plots rapidly became infected from the diseased plants.

Mosaic disease inspection.—*Rept. Dept. Agric. Barbados, 1924–25*, p. 8, 1925.

In accordance with the Mosaic Disease (Eradication) Act, inspections were made from December 10, 1924, to May 31, 1925, after which time in any year no owner or occupier of land on which mosaic disease is found can be compelled to destroy the affected sugar-canes.

Ninety-six estates and 267 small holdings were inspected during this period, 25 (26 per cent.) of the former and 176 (65·4 per cent.) of the latter being found infected by mosaic disease.

GONZÁLEZ FRAGOSO (R.) & CIFERRI (R.). **Hongos parásitos y saprófitos de la República Dominicana.** [Parasitic and saprophytic fungi of the Dominican Republic.]—*Bol. R. Soc. Esp. Hist. Nat.*, xxv, 9, pp. 443–456 ; 10, pp. 508–516, 16 figs., 1925.

The following are a few of the records of interest in this continuation of the series of papers on the parasitic and saprophytic fungi of the Dominican Republic [see this *Review*, v, p. 128], Latin diagnoses of the new species and forms being given. *Asterinella papayae* n. sp. ad int. on dry branches of *Carica papaya*. *Phyllosticta longispora* McAlp. on leaves of *Citrus* sp. in conjunction with *Oospora hyalinula*. *P. perseae* on dry leaves of *Persea gratissima*. *Phomopsis papayae* n. sp. ad int. on dry petioles of *C. papaya*. *Chaetophoma citri* forma *hainensis* n. f. on leaves of *Citrus aurantium*. *Pestalozzia funerea* Desm. (forma *typica* Sacc.) on dry leaves of *Cocos nucifera* (a new host) and living foliage of *Artocarpus incisa*.

Niederlande. Bestimmungen zur Abwehr von für Pflanzen schädlichen Tieren und von Pflanzenkrankheiten bei Ein- und Durchfuhr von trockenen Blumenzwiebeln, Knollen und Wurzelstöcken von Blumengewächsen—Gesetz vom 24. Mai 1924 (Staatsblad No. 262 von 1924). [Holland. Regulations for the exclusion of insect pests and plant diseases in the import and transit of dry flower bulbs, tubers, and rootstocks of flowering plants—Order of 24th May 1924 (Staatsblad No. 262 of 1924).]—*Deutsch. Handelsarch.*, 2. Juliheft, p. 1523, 1925. [Abs. in *Amtl. Pflanzenschutzbestimmungen* (*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*), 3, pp. 42–44, 1925.]

Between 1st July and 31st October all consignments of flower

bulbs, tubers, or rootstocks imported into Holland, whether for use in, or transit through, the country, will be subject to an examination for freedom from plant diseases or insect pests at the port or station of entry by the phytopathological authorities. Diseased material will be retained for disinfection or, where this is impracticable, destroyed or returned to the sender.

Spanien. Einfuhr lebender Pflanzen. Königl. Dekret vom 20. Juli 1924. (Im Auszug.) [Spain. Importation of living plants. Royal Decree of 20th July 1924. (Abstract).]—*Deutsch. Handelsarch.*, 1. Januarheft, p. 74, 1925. [Abs. in *Amtl. Pflanzenschutzbestimmungen (Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst)*, 4, pp. 61–62, 1925.]

The following provisions of this Decree are of phytopathological importance. The importation into and transit through Spain are prohibited in the case of (*a*) living plants or portions thereof attacked by any injurious disease or insect pest; (*b*) bacterial cultures injurious to plants; and (*c*) soil or other substances (inclusive of those adhering to living plants) containing fungi, insects, or parasites injurious to vegetation.

Chile. Sanitäre Pflanzenschutzmassnahmen. Gesetz No. 177 vom 31. Dezember 1924. Im Auszug. [Chile. Sanitary plant protection measures. Order No. 177 of 31st December 1924. Abstract.]—*Deutsch. Handelsarch.*, 1. Juliheft, p. 1390, 1925. [Abs. in *Amtl. Pflanzenschutzbestimmungen (Beil. Nachrichtenbl. Pflanzenschutzdienst)*, 3, pp. 40–41, 1925.]

The *Diario Oficial* (No. 14,067, p. 24, 3rd January 1925) publishes the text of an Order, effective as from 1st February 1925, providing for the examination, at certain scheduled ports, of all plants, seedlings, seeds, fruits, or other vegetable products entering Chile from other countries. The phytopathological officials entrusted with the inspection are authorized to adopt the necessary measures of quarantine, disinfection, or destruction in the case of any material likely to contribute to the spread of plant diseases or insect pests.

Gesetze und Verordnungen. Finnland. [Laws and regulations. Finland.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, v, 12, p. 106, 1925.

As from 5th June 1925, the importation into, transit through, and commerce in Finland of any plants or materials liable to propagate certain diseases and pests will be subject to special regulations which are here briefly defined. The diseases towards which these measures are directed include potato wart (*Synchytrium endobioticum*), apple mildew (*Podosphaera leucotricha*), club-root of cabbage (*Plasmodiophora brassicae*), late blight (*Phytophthora infestans*), mosaic, and other virus diseases of potatoes, black rust of cereals (*Puccinia graminis*), gooseberry mildew (*Sphaerotheca mors-uvae*, fireblight (*Bacillus amylovorus*), and downy mildew of onions (*Peronospora schleideni*).

OGILVIE (L.). **'Agenda put forward by Bermuda delegate'.**—*Proc. Ninth West Indian Agric. Conf., 1924*, pp. 128–133, 1925.

This paper includes certain suggestions made by the Board of Agriculture, Bermuda, with reference to the prevention of the dissemination of diseases and pests in the West Indies as a whole.

It is recommended that the West Indies should, as far as possible, institute Government inspection and certification of exports of nursery stock, and should extend the system of inspecting and grading fruit and vegetable produce prior to exportation. A brief description is given of the inspecting system in force in Bermuda, which covers potatoes, onions, green vegetables, lily bulbs, and other nursery stock, the chief inspector being stationed in New York during the greater part of the season, since most of the trade is with that port. The objects aimed at are to control the dissemination of plant diseases and pests and to secure uniformity and improvement of the grade exported.

Tschechoslowakei. Regierungsverordnung betreffend Massnahmen gegen den Kartoffelkrebs (Synchytrium endobioticum). Vom 17. Juli 1925. (Im Auszug.) [Czecho-Slovakia. Government order concerning precautions against Potato wart (*Synchytrium endobioticum*) of 17th July 1925. (Abstract.)]—*Sammlung der Gesetze und Verordnungen des tschechoslowakischen Staates*, p. 941, 23. Juli 1925. [Abs. in *Amtl. Pflanzenschutzbestimmungen* (*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*), 4, pp. 64–68, 1925.]

As from 1st January 1926, all consignments of potatoes destined for Czecho-Slovakia must be accompanied by a duly authenticated certificate from the phytopathological service of the country of origin, stating that wart disease (*Synchytrium endobioticum*) is not known to occur within a radius of 15 km. of the place of cultivation; further (in the case of potatoes destined for consumption or for manufacturing purposes) by a statement from a responsible official of the phytopathological service to the effect that he has personally supervised the loading and packing of the consignments and found them free from wart disease; and further (in the case of seed potatoes) by a similar statement vouching for the absence of infection and the use of new packing material. Particulars in connexion with customs regulations, &c., are also given. This Order supersedes that of 7th April 1921 [see this *Review*, iv, p. 640].

Schweiz. Bekämpfung des Kartoffelkrebses. (Bundesratsbeschluss vom 5. Oktober 1925.) (Im Auszug.) [Switzerland. Control of Potato wart. (Decree of the Federal Council of 5th October 1925.) (Abstract.)]—*Amtl. Pflanzenschutzbestimmungen* (*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*), 4, pp. 59–60, 1925.

As from 15th October 1925, all consignments of potatoes destined for Switzerland from Denmark, Germany, Holland, Poland, Czecho-Slovakia, and the French Department Haut-Rhin, must be accompanied by a duly authenticated certificate from the phytopathological service of the country of origin, containing, besides other requisite

particulars, the statement that wart disease (*Synchytrium endobioticum*) has not been observed within a radius of at least 5 km. from the place of cultivation.

Regler om kontroll med utførsel av Poteter. [Regulations governing the export of Potatoes.]—Leaflet issued by the Norwegian Department of Agriculture, 3 pp., 21st October, 1925.

As from 1st December 1925 all consignments of potatoes destined for export from Norway will be subject to inspection by officials duly appointed by the Department of Agriculture in order to ensure their freedom from wart disease (*Synchytrium endobioticum*) and *Phthorimaea operculella* [see this *Review*, iv, p. 384]. Potatoes for export must show not more than 4 per cent. of damage from scab [*Actinomyces scabies*] and other injuries. Potatoes from Aust- and Vest-Agder and Hordaland, where wart disease is known to occur, must be accompanied by a declaration that they were grown in certain specified healthy areas.

Schweden. Aenderung der Giftverordnung. (Im Auszug.) [Sweden. Modification of the poisons regulation. (Abstract.)]—*Deutsches Handelsarch.*, 1. Augustheft, p. 1329, 1924. [Abs. in *Amtl. Pflanzenschutzbestimmungen* (*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*), 4, pp. 58–59, 1925.]

A Royal decree of 25th April 1924, effective as from 1st May 1924, provides for certain modifications in the (Swedish) poisons regulation of 7th December 1906. The conditions governing commerce in germisan, uspulun, vetefusariol [weizenfusariol], and other mercury-containing preparations are enumerated.

Preussen. Polizeiverordnung vom 8. September 1925 über den Vertrieb von giftigen Pflanzenschutzmitteln durch Vertriebsstellen des amtlichen Pflanzenschutzes und landwirtschaftliche Körperschaften. [Prussia. Police regulation of 8th September 1925 relating to the commerce in toxic disinfectants through agencies of the official plant protection service and agricultural corporations.]—*Amtl. Pflanzenschutzbestimmungen* (*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*), 4, pp. 55–56, 1925.

This is a revision of the regulations of 14th August 1924 relating to the sale of toxic disinfectants, which are here reclassified under three categories. The special precautions to be taken in commerce with preparations containing arsenic or mercury and their compounds are enumerated.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

Vol. V APRIL 1926

MOURASHKINSKY (K. E.). Новые виды Алтайской микофлоры. [New species of the mycoflora of the Altai Region.]—Reprinted from *Trans. Siberian Acad. of Agric.*, Omsk, v, 3 pp., 1925.

In the present paper are given the Latin diagnoses of ten new species of fungi from the Altai Plateau region [central Russia], several of which are parasitic, though none of these is on a cultivated plant.

WELLENSIEK (S. J.). **Infektieproeven met Rhizoctonia en Moniliopsis op Tomaat en Aardappel.** [Inoculation experiments with *Rhizoctonia* and *Moniliopsis* on Tomato and Potato.]—*Tijdschr. over Plantenziekten,* xxxi, 11, pp. 236–250, 2 pl. 1925.

Inoculation experiments were conducted on tomatoes and potatoes with a *Rhizoctonia* isolated from tomatoes in 1925; two cultures of *R. solani* isolated from potatoes in 1917 and 1925, respectively; and *Moniliopsis aderholdi* isolated from *Cinchona*.

It was shown that foot rot of tomatoes can be caused by *R. solani*, and it is therefore inadvisable to cultivate this crop in soil previously used for potatoes.

The *Rhizoctonia* isolated from tomato was found to attack potatoes more virulently than that from the latter host. Conversely, the *Rhizoctonia* from potatoes produced more severe effects on tomato than that from the latter, the fungus apparently preferring another plant to its original host.

There was found to be no diminution in the virulence of eight-year-old cultures of *R. solani*.

As in former tests [see this *Review*, iii, p. 557] *M. aderholdi* failed to attack either potatoes or tomatoes under conditions in which *R. solani* gave positive results. It is therefore concluded that the identification of these two organisms by Duggar (*Ann. Missouri Bot. Gard.*, iii, p. 1, 1910) and Thomas [see this *Review*, iv, p. 444] is based on insufficient evidence, and that the name *M. aderholdi* should be retained pending further investigations.

ARTHUR (J. C.). **(Uredinales) Additions and corrections (continued).**—*North American Flora*, vii, 10, pp. 669–732, New York Botanical Garden, 1925.

The revision of the Uredinaceae, continued from part 9, is completed, and that of the Aecidiaceae commenced. Recently described genera are inserted in their correct position or referred to synonymy, and species which have been transferred to other genera are noted under each genus. When necessary, the diagnoses of genera and species have been revised.

The Tea Research Institute.—*Trop. Agriculturist*, lxv, 5, pp. 259–260, 1925.

An Ordinance sanctioned by the Ceylon Legislative Council provides for the establishment, incorporation, and maintenance of a tea research institute, supported by funds from the tea industry itself and managed by a Board nominated by that industry. Close co-operation between the institute and Government is provided for by the appointment of two official members on the Board.

TUNSTALL (A. C.). **The concentration of lime-sulphur solution.**—*Quart. Journ. Indian Tea Assoc., 1925*, 3, pp. 114–116, 1925.

The formula for the preparation of home made lime-sulphur recommended by the Indian Tea Association, namely, 20 lb. quicklime, $22\frac{1}{2}$ lb. sulphur, and 50 galls. water [see this *Review*, v, p. 137], is stated to yield a solution of remarkably constant strength. The lime is slaked in a drum of 50 galls. capacity and, when fully slaked, 30 galls. of water are added and it is brought to a boil. When boiling, the sulphur is added gradually with thorough stirring, and boiling water is then poured in to bring to 50 galls. The solution is then boiled for an hour longer, boiling water being added to keep the volume at 50 galls. The resulting solution has a specific gravity of about 8° Baumé, and for use is diluted 1 in 2 or 3 in the cold season and 1 in 6 to 8 in the growing season. Tables are given for diluting commercial concentrated lime-sulphur of different specific gravities for use in the two seasons on ordinary and heavy pruned tea and on nursery plants.

Unpruned well-grown tea is said to require 200 to 300 galls., and high pruned, 150 to 200 galls., of the dilute solution per acre, applied with an Indian Tea Association 4-nozzle attachment; while low pruned tea requires 100 to 150 galls. per acre, and seedlings of a year old 40 galls. per 1,000 plants, applied with an ordinary single nozzle.

DICKSON (B. T.). **Tobacco and Tomato mosaic. (1). Longevity of the virus of Tobacco mosaic.**—*Science*, N.S., lxii, 1609, p. 398, 1925.

On 25th May 1925 two leaves of each of four healthy tobacco plants were inoculated with a small portion of expressed, unfiltered juice from mosaic tobacco plants which had been kept since February 1920. On 15th June each of the four plants showed definite symptoms of mosaic, while two controls remained perfectly healthy. Similar results were obtained with four other plants inoculated on 25th June, which developed mosaic by 10th July.

It is evident from these data that the expressed juice of mosaic tobacco plants retains its infectiveness after five years *in vitro*.

Dickson (B. T.). **Tobacco and Tomato mosaic. (2). Streak of Tomato in Quebec a 'double-virus' disease.**—*Science*, N.S., lxii, 1609, p. 398, 1925.

During laboratory studies which have been in progress since 1923 it was observed that tomato plants naturally or artificially infected with the streak virus [see next abstract] often tend to outgrow streak symptoms in the upper part of the plant, which always, however, shows signs of mosaic. The virus of tomato streak inoculated into tobacco consistently caused mosaic, while a transfer from the tobacco so inoculated frequently reproduced streak in tomato. This suggested the possibility of double infection, and experiments to test this view were conducted both in the greenhouse and in the field.

It was shown that healthy tomato plants inoculated with a mixture of viruses from mosaic-diseased tomato and potato, or tobacco and potato, develop streak in about 14 days. Mosaic-diseased tomato plants inoculated with virus from mosaic-diseased potato develop streak; while virus from diseased potato, alone, produced only doubtful mosaic in healthy tomato. Juice from a tobacco plant showing mosaic after inoculation with tomato and potato mixed virus gave rise to streak when inoculated into healthy tomato.

Combinations of bean and raspberry mosaic viruses with tomato mosaic virus gave negative results.

These data are considered to show that, in Quebec, streak or stripe of tomato is not due to *Bacillus lathyri* [see this *Review*, iii, p. 197] but is a disease resulting from double inoculation, i. e., with virus of potato and tomato (or tobacco) mosaic.

Vanterpool (T. C.). **The stripe or streak disease of Tomatoes in Quebec.**—*Sixteenth Ann. Rept. Quebec Soc. Prot. Plants, 1923–1924*, pp. 116–123, 2 pl. [Received 1925.]

After a brief review of previous investigations in relation to similar diseases of tomatoes [see this *Review*, ii, pp. 256, 430, 443; iii, p. 197], the author gives a progress report of observations at Macdonald College, Quebec, in 1924, on the so-called stripe or streak disease first referred to in Canada by Howitt and Stone (*Phytopath.*, vi, pp. 162–166, 1916). This disease is characterized by the development, about the time when flowering begins, of a long spindling growth of the upper part of the plants. At the same time necrotic streaks develop in a zone of about a foot in length, some two-thirds up the plant. In this zone the leaves show irregular, yellow spots, variously grouped, which darken and are followed by complete necrosis of the spots and curling or shrivelling of the leaves. The stems and petioles show brown, oblong or linear, sunken markings. The leaves of the upper, spindly zone are small and with numerous yellowed, minute, necrotic areas. Infected plants usually remain in this condition for some weeks without dying, but sometimes wither early. The lesions on the petioles have a more water soaked and shrunken appearance than those on the stem, causing the petiole to shrivel, turn brown, and dry up. The lesions on the

sepals are relatively small and not elongated. On the fruit are dark brown, shiny, sunken, irregular patches, which may become cracked as they dry out. Severely affected fruits tend to be deformed. A superficial bronzing on the leaves of the necrotic zone is frequently visible, and on examination microscopically it is found that the multicellular ends of the glandular hairs are all dark brown. Attention is drawn to the fact that all the plants under observation as suffering from the disease were infected simultaneously with mosaic, although in many cases the latter was not clearly apparent at first.

Sections show that the necrotic tissue may occasionally extend well into the cortex, and even the pith, in the stem and petiole, the vascular elements being, as a rule, unaffected. Small, brown patches may also be observed within the tissues. All the tissues, except the vascular bundles, become necrotic under the leaf spots. On the fruit the lesions are usually superficial, though occasionally brown patches are found in the deeper tissues. Affected leaves were found to possess an abnormal number of cells containing shining crystalline deposits, but no clear histological evidence of the presence of bacteria was obtained.

As regards the distribution of stripe in the greenhouse, it was clearly evident that the outer rows in each infected bed were much more commonly attacked than the inner ones.

Numerous attempts to isolate a causal organism from diseased tissue were made, but only in a few cases (the majority being from internal stem lesions) was a yellow, motile bacillus obtained. Inoculations with this were, in the majority of cases, unsuccessful. It was found possible, on the other hand, to transmit the disease by rubbing the leaves of healthy plants with crushed tissue of diseased plants. Furthermore, stripe disease was produced in tomatoes by rubbing the latter with crushed leaves of mosaic tobacco, while mosaic of tobacco was similarly produced from striped tomatoes. These experiments are considered to support the view adopted by Dickson [see preceding abstract] that the disease is a form of mosaic in which necrosis occurs under certain environmental conditions.

R. (O.). **Stengelerkrankung der Tomate.** [Stem blight of the Tomato.]—*Die Kranke Pflanze*, ii, 11, p. 229, 1925.

Stem blight of tomatoes (*Diplodina lycopersici*) [*Didymella lycopersici*: see this *Review*, i, p. 150] is stated to have caused heavy damage in the Lössnitz district of Saxony in 1921. On the recommendation of the Plant Protection Station, the writer burnt the roots and foliage of the affected plants, painted the supporting sticks with milk of lime or carbolineum, and disinfected the seed-beds for the next crop with uspulun dust. This treatment completely eliminated all trace of the disease.

Jørstad (I.). **Norske skogsykdommer. 1. Nåletre-sykdommer bevirket av Rustsopper, Ascomyceter og Fungi Imperfecti.** [Norwegian forest diseases. 1. Diseases of conifers caused by Rusts, Ascomycetes, and Fungi Imperfecti.]—Reprinted from *Medd. Norske Skogforsøksvesen*, 6, 186 pp., 1925. [English summary.]

This monograph aims at giving a fairly comprehensive account,

based on personal observations as well as on a study of the relevant literature and of material preserved in the botanical museum of Oslo University, of the principal conifer diseases caused by rusts, Ascomycetes, and Fungi Imperfecti. The hosts are divided into groups as follows: (1) two-needled species of *Pinus*; (2) five-needled species of *Pinus*; (3) *Picea*; (4) *Abies* and *Pseudotsuga*; (5) *Larix*; (6) *Juniperus*; (7) *Taxus*; and (8) nursery trees.

The following are some of the numerous records of interest in each group: (1) *Cronartium pini*, in its aecidial stage, *Peridermium pini* f. *corticola*, causes heavy damage on *P. sylvestris* in the northern, coastal, and mountain forests, especially in Finmark. The uredo-teleuto stage (*C.* '*asclepiadeum*') is stated to be rare in Norway and of no importance in the propagation of the fungus.

Dasyscypha subtilissima and *D. resinaria* cause cankers on the trunks and branches of *P. sylvestris* and other species. *Crumenula pinicola* causes trunk cankers of pines in the northern part of the country, and kills younger branches without canker formation.

Excipulina pinea, which produces a characteristic twig disease, is believed to have been largely responsible for the gradual disappearance of *P. austriaca* in Scandinavia.

Lophodermium pinastri, which is extremely common on *P. sylvestris*, and occurs also on a number of other species, causes much damage in nurseries, and has been observed on weakly individuals in older plantations.

Hypodermella sulcigena is common all over the country on *P. sylvestris*, *P. austriaca*, and *P. montana*. The supposed pycnidial stage, *Hendersonia acicola*, has been found on needles infected by this *Hypodermella* under humid conditions.

Phacidium infestans is a severe parasite of *P. sylvestris* in all parts of the country.

(2) White pines (*P. strobus*) free from blister rust (*Cronartium ribicola*) are stated to be of rare occurrence, and the practical extinction of this tree after nearly 100 years' cultivation in Norway must be exclusively attributed to this disease. The uredo- and teleutospores are most commonly found on black currants (*Ribes nigrum*), but occur also on other species of *Ribes* [see also this *Review*, ii, p. 483].

(3) The aecidial stage of *Thecopsora areolata* is very common on the cones of *Picea excelsa* near the Arctic circle, where it may considerably reduce the spruce seed crop. The alternate stage of this fungus occurs on *Prunus padus*, *P. virginiana*, and cultivated cherries (*P. avium* and *P. cerasus*) and plums (*P. domestica*), causing a serious shot hole of the foliage which was very prevalent in 1924 and 1925 near Oslo.

Hypodermella macrospora sometimes causes heavy damage to *P. excelsa* and *P. pungens*, killing a large percentage of one-year-old needles, which may remain adhering to the trees for an indefinite period.

Herpotrichia nigra destroyed 100,000 young spruce trees in one nursery in 1923; it occurs also on *P. alba*.

(4) *Rehmiellopsis abietis* Rostr. (*R. bohemica* Bubák) [see this *Review*, iv, p. 198] attacks the young leaves of *Abies pectinata* and *A. pinsapo*. The pycnidial stage, *Phoma bohemica*, has not been observed in Norway.

(5) *Godronia pineti* n. sp. has been found producing a bark canker and probably killing the top of a Siberian larch near the Arctic circle. *Meria laricis*, which produces a needle cast disease, has been seen only once, in a nursery of *Larix europaea*.

(6) Junipers are attacked by three species of *Gymnosporangium*, namely, *G. clavariaeforme*, *G. corniferum* (*G. juniperi*), and *G. penicillatum* (*G. tremelloides*); and also by *Herpotrichia nigra*, which is common and often kills whole branches by attacking their needles while covered with snow.

(7) The following fungi have been found on the needles of *Taxus baccata*: *Gloeosporium taxicolum*, *Phoma hysterella*, and the perithecia of a fungus closely resembling *Rehmiellopsis abietis*.

(8) The principal nursery diseases are damping-off, associated with *Fusarium* spp., *Phytophthora omnivora*, *Pythium de Baryanum*, and *Botrytis cinerea*; and stem girdle (*Pestalozzia hartigii*).

A bibliography of 163 titles is appended.

Wolf (F. A.). **Some undescribed fungi on Sourwood, Oxydendron arboreum (L.) DC.**—*Journ. Elisha Mitchell Sci. Soc.*, xli, 1–2, 2 pl., 1925.

Of the three new species of fungi described in the present paper, namely, *Sphaerella caroliniana*, *Sphaerulina polyspora*, and *Venturia oxydendri*, collected by the author on sourwood (*Oxydendron arboreum*), in North Carolina, the first two are parasitic on the host, which is stated to be of some economic importance as a honey yielding plant.

Sphaerella [*Mycosphaerella*] *caroliniana* forms on the leaves reddish to purplish stains which begin to appear about the middle of July and which may later become so numerous as to cause the premature defoliation of the trees. On the central portions of the older spots are produced hypophyllous, black pycnidia, 90 to 100 μ in diameter, with walls consisting of a single layer of cells, and containing hyaline, oblong conidia, from 5 to 7 by 2 to 3·5 μ in diameter. In the autumn the conidia are replaced, apparently inside the pycnidia, by spermatia 4 to 5 by 1·4 μ in diameter and characteristically enlarged at both ends. All attempts to germinate the spermatia failed. In March, the fallen decaying leaves bear numerous mature perithecia of the same size as the pycnidia, containing clavate asci, 40 to 45 by 7 to 8 μ. The ascospores are biseriate, 9 to 11 by 3 to 5 μ in diameter, unequally two-celled (the apical cell larger), and germinate usually with a germ-tube at each end. Proof of the relationship of the pycnidial (*Phyllosticta*) and ascigerous stages rests on the similarity of the colonies in culture, and on their association in succession in the same lesions.

Sphaerulina polyspora produces a die-back disease, and appears to gain entrance through twigs which are injured by fire or are moribund from other causes. The affected twigs may be recognized by the presence on them of pycnidia of a species of *Phoma*. The pycnidia average 175 μ in diameter and contain hyaline, ellipsoid conidia, measuring 7 to 8 by 3·8 μ. In spring, perithecia are abundantly present on the affected twigs; they vary in size from 150 to 180 μ and arise within the cortical parenchyma. The asci are 90 to 100 by 18 to 20 μ, and contain eight hyaline, 3- to 5-septate,

constricted ascospores, 20 to 24 by 6 to 7 μ. On germination the conidia and ascospores enlarge and become septate in more than one plane, or yeast-like colonies of budding cells are developed. Sometimes short hyphae are formed, but the mycelium is never of sufficient length to extend beyond the margin of the colony.

Venturia oxydendri was found only on fallen leaves. It is briefly described.

Latin diagnoses of the three fungi are appended.

HAFIZ KHAN (A.). **The artificial development of sporophores of Polyporus gilvus (Schw.) Fr. & Pat.**—*Indian Forester*, li, 5, pp. 205–207, 1925.

A method of obtaining the sporophores of *Polyporus gilvus* (a suspected root parasite of *Dalbergia sissoo* in Dehra Dun, India) is described. Slabs cut from infected sapwood containing living hyphae were surface sterilized by flaming in alcohol, placed in sterile potato tubes, and transferred after 48 hours to glucose agar. Three days later the mycelium that grew from one of the slabs was inoculated into three healthy and three diseased slabs (previously autoclaved) of sapwood. Two of the cultures on rotted wood began to form crusts after 24 days, and by transferring the tubes to a humid atmosphere in a wide-mouthed, stoppered bottle, and exposing them to the sun for two hours daily, fertile sporophores, resupinate or with a rudimentary bracket formation, were obtained.

The cultures on healthy wood did not form crusts, and it is suggested that a certain stage of wood decay is requisite for fructification.

SNELL (W. H.), HOWARD (N. O.), & LAMB (M. U.). **The relation of moisture contents of wood to its decay.**—*Science*, N.S., lxii, 1608, pp. 377–379, 1925.

The first-named writer's investigations in connexion with the decay of structural timbers [see this *Review*, ii, p. 146; iii, p. 182] have been continued with the aid of two colleagues. The objects of the experiments described in this note, which were conducted with *Lenzites sepiaria*, *L. trabea*, *L. lepideus*, *Trametes serialis*, *T. carnea*, and *Fomes roseus*, were (1) to obtain some general data on the relation of the air-moisture balance to the decay of a common light wood such as Sitka spruce [*Picea sitchensis*], with particular reference to the practical problems involved in the preservation of structural timber, &c.; (2) a comparison of the air-moisture requirements of the organisms used in the tests; and (3) the correlation between the air-moisture balance and the specific gravity of the decayed wood. The technique of the experiments, each of which was allowed to run for a year, was similar to that used in previous investigations [loc. cit.].

Preliminary data from these tests (which are stated to be still incomplete in certain particulars) showed that the upper limit of optimum growth for the fungi (taken collectively) on Sitka spruce (specific gravity 0·34) was at a moisture content of 150 per cent. of the oven dry weight of the wood; on southern pine [*Pinus palustris*] sapwood (sp. gr. 0·44), 110 per cent.; and on Douglas fir [*Pseudotsuga taxifolia*] (sp. gr. 0·57), 80 per cent. The corre-

sponding inhibition points of decay were 200, 160, and 125 per cent.

In general, the decay occurring at moisture contents from the fibre saturation point of oven-dried wood up to a falling-off point is approximately similar for all the fungi tested, though some showed a tendency to greater decay at moisture percentages above the fibre saturation point. Presupposing that a certain definite volume of air is necessary to promote the growth of these wood destroying organisms, the moisture content favouring the maximum amount of decay or inhibiting it entirely will vary inversely with the specific gravity; the small lumina and hence small amount of air available for fungous growth is apparently the determining factor in the durability of heavy woods. Further tests are in progress to supplement these data.

Kögl (F.) & Taeuffenbach (G. v.). **Untersuchungen über Pilzfarbstoffe. IV. Ueber das Xylindein, den Farbstoff des grünfaulen Holzes (1).** [Investigations on the colouring matters of fungi. IV. Concerning xylindein, the colouring matter of green decayed wood (1).]—*Liebigs Ann. Chem.*, cdxlv, 2–3, pp. 170–180, 1 fig., 1925.

An account is given of the extraction of xylindein from the green mould of decayed beech, oak, and birch wood (*Peziza aeruginosa*) [*Chlorosplenium aeruginosum*] by means of phenolum liquefactum. The chemical reactions of the resulting green product are described.

Der amerikanische Markt für Kreosot und andere Holzkonservierungsmittel. Englische und deutsche Lieferungen. [The American market for creosote and other timber preservatives. English and German deliveries.]—*Chem. Indus.*, xlviii, 45, pp. 757–758, 1925.

During 1922 the quantity of creosote required in the American wood preservation industry was 87,800,000 gallons, 41 per cent. of which had to be imported from England and Germany. In 1923 England exported 41,400,000 gallons of creosote to the United States, and it is estimated that the bulk of the 20,900,000 gallons exported from Great Britain during the first half year of 1925 was destined for the same purchaser. Notwithstanding these large quantities of imported creosote, the consumption of home produced zinc chloride in the American wood industry increased by 4,000,000 lb. in 1924 as compared with 1923. The combined application of zinc chloride and petroleum or creosote, or a mixture of both, is stated to have given very satisfactory results. Petroleum is preferred to creosote for this purpose, and efforts are being made, e.g., by the Grasselli Chemical Company by means of a petroleum preparation containing arsenic compounds, to dispense altogether with the latter. In 1924 the consumption of petroleum in combination with creosote amounted to 11,000,000 gallons compared with 4,000,000 in 1923. The use of fluorides, nitro-compounds, and the like, though slowly gaining ground, only accounts for 10 per cent. of the total consumption of preservatives in the United States.

SCHANTZ (C.). **Untersuchung auf Imprägnierung von Holz mit Metallsalzen durch Röntgenstrahlen.** [Examination of the impregnation of wood with metallic salts by Röntgen rays.]—*Zeitschr. Angew. Chemie*, xxxviii, 46, pp. 1044–1045, 1925.

Moll's conclusion that Röntgen rays are not suitable for the examination of the impregnation of timber with metallic salts [see this *Review*, v, p. 11] is stated to be based on insufficient data and the use of a faulty technique. In order to produce the requisite variations of intensity in the rays, it is necessary to use sections of wood measuring at least 200 mm. in thickness. It will be found that in such material corrosive sublimate can be detected at a greater depth in the wood by means of the rays than with ammonium sulphide.

LUDWIGS (K.). **Die Bekämpfung der Kohlhernie (Plasmodiophora brassicae).** [The control of club-root of Cabbage (*Plasmodiophora brassicae*).]—*Mitt. Deutsch. Landw. Gesellsch.*, xl, 17, pp. 314–316, 1925.

An account is given of the principal investigations carried out during recent years in Germany and elsewhere on the control of club-root of cabbage (*Plasmodiophora brassicae*), most of which have already been noticed in this *Review*.

OCFEMIA (G. O.). **The occurrence of the white rust of crucifers and its associated downy mildew in the Philippines.**—*Philipp. Agric.*, xiv, 5, pp. 289–296, 2 pl., 1925.

White rust of crucifers (*Cystopus candidus*) and downy mildew (*Peronospora parasitica*) were observed for the first time in the Philippines in March 1925 on mustard (*Brassica juncea*) and pechay (*B. pekinensis*). The diseases are of very little economic importance and may be readily controlled by general sanitary measures.

SOLBERG (LOUISE). **Sygdom paa Erter.** [A disease of Peas.]—Reprinted from *Havedyrkningens Venners Medlemsskr.*, 4, 6 pp., 3 figs., 1925.

The writer observed the root rot of peas caused by *Aphanomyces euteiches* [see this *Review*, v, p. 69] in various parts of Norway in 1924. The disease is stated to be particularly severe on Dippe's Early May and all strains of the English Sword Sugar peas. Varieties with large seeds, such as the *Fusarium*-resistant Non Plus Ultra and Unwin's English varieties, appear to be resistant.

The first sign of the disturbance is a greyish-brown discoloration of some of the nodules, which are subsequently attacked by nematodes. The rootlets on which the affected nodules are situated are frequently brown and wilted. Early sown peas have, in general, shown greater susceptibility to root rot than those sown later.

A. euteiches seems to be ubiquitous in the soil and has been isolated by the writer from a number of plants related to the pea, including sweet peas [*Lathyrus odoratus*], clover, beans, and lupins. Each host appears to be attacked by a different biological form of the fungus. It is thought that *A. euteiches* may be one of the causes of clover sickness.

The only control measures which can be recommended at present are protracted crop rotation and plentiful applications of organic manure.

WINGARD (S. A.). **Studies on the pathogenicity, morphology, and cytology of Nematospora phaseoli.**—*Bull. Torrey Bot. Club*, lii, 6, pp. 249–290, 3 pl., 1925.

The author discusses the morphology and phylogenetic relationships of the genus *Nematospora*, one of a series of yeast genera with long, needle-shaped ascospores. Five species are recognized, all remarkably similar morphologically: *N. coryli*, *N. lycopersici*, *N. phaseoli*, and the species C and D of Nowell (*West Indian Bull.*, xvi, pp. 152–159, 1917). The species A and B of Nowell are not thought to be congeneric with these, not having the ascospore characters of *Nematospora* and not multiplying by budding. B was originally stated to resemble *Eremothecium cymbalariae*, and the author thinks that it is either identical with or closely related to that organism, which, together with *Protascus*, require further study before their true systematic position can be determined. *Monotospora* and *Coccidiascus* have certain characters indicating close relationship to *Nematospora*, all these three genera being clearly yeasts.

Cytological studies of *N. phaseoli*, isolated by the author from diseased Lima beans (*Phaseolus lunatus*) in Virginia [see this *Review*, ii, p. 194], have shown that the spore-bearing body is undoubtedly an ascus. The latter is formed from a uninucleate cell, the nucleus having five chromosomes. In some cases the ascus results from the conjugation of the germ-tubes of two ascospores and there is evidence in such cases that the single nucleus of the ascus results from the fusion of the two nuclei in the germ-tubes. In other cases an ascus appears to result from the fusion of two yeast cells. In still others it may arise from a single yeast cell or directly from the basal cell of the ascospore. The (normally eight) ascospores are produced by three divisions of the original nucleus just as in other Ascomycetes.

Ascospores are produced in great numbers on Lima bean cotyledons and on several nutrient media provided frequent transfers are made. Growth in liquids is not so abundant as on solid media, and few mycelial filaments, with practically no asci, develop in beer wort. In water there is a flocculent growth of mycelial filaments with intercalary asci. On solid media a rudimentary mycelium may be formed around the borders of old colonies. Usually, however, the vegetative phase of *Nematospora* is yeast-like, and an alcoholic odour is given off in beer wort. The minimum temperature for growth on beer wort agar is about 15° C. and that for ascospore formation about 18°, optimum for both 25° to 30°, and maximum 40° and 34°, respectively.

A list of 22 host plants of *Nematospora* and its allies, and also a brief account of parasite yeasts generally, are given. *N. phaseoli* was shown to attack the fruits of *P. lunatus*, *P. vulgaris*, and *Vigna sinensis* and also the tubers of the sweet potato, in all cases through wounds only. Insect punctures are the normal channel of infection. As with the other members of the genus, no infection of

stems or leaves has been observed. The small Lima bean (Sieva bean) is the most severely infected and is very subject to the disease. Infection may occur at any stage of development of the bean, but only causes severe damage when it takes place before the latter is half grown. The insect concerned in this case is *Nezara hilaris*, but whether it is a host of *Nematospora phaseoli* or merely conveys the latter is not known. The severity of infection depends directly on the number of insects present and a suitable temperature range. This is the reason why the disease is most active during the latter part of the season.

RANDS (R. D.) & BROTHERTON (W.). **Bean varietal tests for disease resistance.**—*Journ. Agric. Res.*, xxxi, 2, pp. 101–154, 3 pl., 1925.

This paper records the results of an investigation during 1920–1923 of the varietal resistance of beans to bacterial blight (*Bacterium phaseoli*) [see this *Review*, iii, p. 499] and to the various biologic forms of anthracnose (*Colletotrichum lindemuthianum*) [see this *Review*, iii, p. 110], the two most important diseases of beans in the eastern United States. Incidental notes on bacterial wilt (*Bact. flaccumfaciens*) [see this *Review*, iii, p. 117] and mosaic are also given.

Altogether 663 varieties and strains of beans have been tested, of which 170 were American and 493 from 23 other countries. The data on the reaction of each variety are tabulated on 36 pages, and were obtained from greenhouse tests and from field plot inoculations. Field conditions rarely proved as severe as those maintained in the greenhouse, where varieties which are seldom more than slightly infected under commercial cultivation may be moderately or even severely attacked.

Of the varieties on which fairly conclusive results have been obtained, 65 appear to possess decided resistance to *C. lindemuthianum* or *Bact. phaseoli*, of which 5 are resistant to both diseases, 27 to the former only, and 33 to the latter only (although a few of these, judging from field tests, may also prove commercially resistant to *C. lindemuthianum*). Six of the 27 varieties resistant to *C. lindemuthianum* are practically immune from all known biologic forms of the fungus [loc. cit.], whilst the remainder were affected only to a slight or very slight extent. No very high degree of resistance to *Bact. phaseoli* was observed in any variety of *Phaseolus vulgaris* tested, although a number of foreign varieties showed signs of being somewhat more resistant than any of the American types.

The adaptability and commercial value of the few standard American and European resistant varieties are fairly well known, and they could probably replace some of the very susceptible varieties grown in the United States. Little is known regarding the horticultural value of the varieties from other countries; some at least are late pole types of tropical or semi-tropical origin, and will be mainly valuable for hybridization purposes.

The information regarding *Bact. flaccumfaciens* is not sufficiently complete to serve as a basis for judging relative susceptibility, although the 15 varieties which appeared least affected may prove to be somewhat resistant to this disease.

Tests on 11 other species and genera of beans related to *Phaseolus vulgaris* were also carried out, and are briefly summarized. *Phaseolus angularis*, *P. aureus*, and *P. mungo* were not infected with anthracnose, but were slightly susceptible to bacterial blight.

RAMBOUSEK (F.). **Ochrana Řepných polí v zimě a na jaře.** [Protection of Beetroot fields in winter and spring.]—*Ochrana Rostlin*, v, 4–5, pp. 62–67, 5 figs., 1925.

The present paper deals with the principal diseases and pests of sugar beet in Czecho-Slovakia, with special reference to the measures requisite for their prevention, rather than for their control. The statement is made that most of these diseases are more dependent on the nature and cultivation of the soil than on the virulence of the pathogens, the more so that the beet is one of the hardiest and most disease-resistant among cultivated plants.

The most common and widespread disease is the root rot caused by *Rhizoctonia violacea*, which occurs in fields where the crop is grown several years in succession; its outbreak may be prevented by crop rotation, care being taken not to grow clover on the fields intended for beet, as clover is also a host for this fungus. Heart rot caused by *Phoma betae* is chiefly disseminated by the grubs and larvae of the 'spring beetle', and only occurs in particular localities; proper cultivation should be sufficient to control it effectively. All the other root diseases of the beet, e. g., scab [*Actinomyces* spp.], dry rot, &c., are considered by the author to be secondary infections, due to the action of organisms following on physiological disturbances of the plants caused by lack or excess of soil moisture, weather conditions, and the like. Their prevention is also easily attainable by improved cultivation, involving crop rotation and amelioration of the soil.

Among the leaf diseases of the beet, the most frequent is that caused by *Cercospora beticola* Sacc., which forms rounded, grey spots with red margins; the spores of this fungus were shown to be capable of passing through the alimentary tract of cattle without losing their germinability, and the inference is that the diseased leaves should not be fed to cattle. Other dangerous diseases which are gaining ground in Czecho-Slovakia are *Sporidesmium putrefaciens* and *Peronospora schachtii*, and their attacks may, perhaps, be prevented or checked by disinfecting the diseased fields with unslaked lime, formalin, or other fungicides, combined with crop rotation.

UZEL (J.). **Krankheiten und Schädigungen der Zuckerrübe.** [Diseases and injuries of the Sugar Beet.]—*Chem. Tech.* (Prague), 43 pp., 98 figs., 1924. (Czech.)—[Abs. in *Bot. Centralb.*, N.F., vi, 7–8, p. 253, 1925.]

The author describes the results of his observations, extending over 25 years, of bacterial, fungous, and physiological diseases and insect pests of the sugar beet in Czecho-Slovakia. Conditions in storage pits and the chemical control of diseases are also discussed.

ANDERSON (P. J.). **Comparative susceptibility of Onion varieties and of species of Allium to Urocystis cepulae.**—*Journ. Agric. Res.*, xxxi, 3, pp. 275–286, 1925.

The origin of onion smut (*Urocystis cepulae*), which is considered

to be quite distinct from the four other species of *Urocystis* attacking various European species of *Allium*, is thought to be probably from some wild species in America, where the disease has been known since about the middle of the last century.

An account is given of the author's experiments [the results of which are presented in tabular form] to determine the susceptibility to smut of a number of varieties of the cultivated onion (*Allium cepa*). Of the 54 American and European varieties tested, none showed any distinct resistance to smut. Out of 39 species of *Allium* of which viable seed could be procured, eight appeared to be immune and the other 31 could be arranged in classes showing differences in the degrees of resistance. Thirteen of these, including the shallot (*A. ascalonicum*), were in the same class as *A. cepa* in regard to susceptibility; another 13 had sori only in the cotyledons without killing the seedlings; and the remaining five resembled the last, except that some seedlings were killed. Leeks (*A. porrum*) were in this last class. Onions started from bulblets remained wholly free from smut.

SM[OLAK] (J.). **Různě Zpravy. Septoriosa celeru.** [Miscellaneous information. Septoriose of Celery.]—*Ochrana Rostlin*, v, 3, p. 48, 1925.

In 1925 celery in Czecho-Slovakia suffered exceptionally heavily from attacks of *Septoria apii* both in the field and in storage, and very considerable financial losses were incurred by growers owing to their general under-estimation of the economic importance of the disease. Stress is laid on the necessity of taking sanitary precautions, i. e., removing and destroying all the infected leaves, and also of treating the seed for 2 to 3 minutes in a 1 per cent. solution of corrosive sublimate, as the fungus is known to be carried on the seed.

OCFEMIA (G. O.). **The Phytophthora disease of Eggplant in the Philippine Islands.**—*Philipp. Agric.*, xiv, 6, pp. 317–328, 2 pl., 4 graphs, 1925.

Since 1918 *Phytophthora melongenae* Sawada [see this *Review*, ii, p. 436] has occurred every year at Los Baños, sometimes causing considerable damage to the fruits of eggplant (*Solanum melongena*). From November 1923 to August 1924, climatic and other environmental conditions were favourable to the development of the disease, which attacked 25 to 75 per cent. of the fruit in the garden of the College of Agriculture.

The only other country from which the *Phytophthora* disease of eggplant has been reported is Japan (*Mycologia*, ix, p. 249, 1917). The Philippine *Phytophthora* differs in certain respects from the Japanese form. The conidia of the former are ovate, granular, hyaline, with a prominent papilla, measuring on an average 34·8 by 28·4 μ; while those of the Japanese *Phytophthora* are described as spherical, broad oval, or oval, and measuring 42·4 by 33·9 μ. The ratio of length to breadth is 1·225 in the Philippine and 1·221 in the Japanese fungus. The chlamydospores of the Philippine *Phytophthora* are spherical, terminal or intercalary, hyaline to slightly yellowish, finely granular, and thin walled, measuring 27·5 to

29·49 μ, while those of the Japanese form are described as yellowish-brown, spherical, and measuring 25 to 42 μ. The Philippine fungus produced occasional spherical, yellowish-brown, thick walled oospores, measuring 16 to 24 μ, borne in oogonia of 24 to 32 μ, on oatmeal agar and other media. The Japanese *Phytophthora* is described as producing oospores, measuring 17 to 21 μ, on bean agar, borne in oogonia of 18 to 23 by 20 to 24 μ. The conidia of the Philippine *Phytophthora* germinate by the production of either germ-tubes or not more than twelve spherical zoospores, the latter measuring 5·4 to 10·08 μ in diameter. The Japanese form is stated to produce as many as 40 ovoid or ellipsoid zoospores, measuring 10 to 11 by 8 μ. These differences are not considered sufficiently important to justify a separation of the Philippine and Japanese forms. Inoculation experiments were carried out on egg-plants with positive results. It was shown by field tests that the fungus is parasitic on the fruit from the time the petals fall until maturity. Other hosts infected by *P. melongenae*, especially when wounded, include pomelo (*Citrus maxima*) bark, chilli pepper (*Capsicum annuum*) fruits, tomato fruits, lettuce leaves, and potato stems.

A brief account is given of the development and spread of the fungus under field conditions. Control measures should be based on general sanitation, comprising wide planting, removal of diseased material, deep ploughing, and (where the crop is grown commercially) fortnightly applications of Bordeaux mixture (4–4–50).

CURZI (M.). **Il parassitismo del 'Verticillium tracheiphilum Curzi' e la diffusione della 'tracheoverticilliosi' del Peperone in Italia.** [The parasitism of *Verticillium tracheiphilum* Curzi and the spread of tracheoverticilliosis of Chillies in Italy.]—*Riv. Patol. Veg.*, xv, 9–10, pp. 145–160, 3 figs., 1925.

The author's preliminary experiments indicated that the wilt of chillies (*Capsicum annuum*) in Italy is due to a species of *Verticillium* which he has named *V. tracheiphilum* [see this *Review*, iv, p. 650]. Subsequent inoculation experiments, which are described in the present paper, have shown that the effects of infection differ according to the stage of development of the host plant. Plants inoculated while they are still in active growth are checked in their development and remain stunted, with shortened internodes and small leaves, the borders of which are raised and rounded. The fruit never attains its full volume, and is usually deformed as a result of an arrest of development which is confined to one side. Such plants show no true wilting or only a slow form which progresses from the base upwards. Inoculated mature plants, on the other hand, show the characteristic wilting and rapid withering in the reverse direction (from the top of the foliage downwards). This wilting began 15 to 25 days after inoculation and was sometimes partial, being confined to certain branches for at least some time. The inoculated plants put out new shoots from the collar.

The partial wilting is believed to be associated with the limited development of the mycelium in the vessels, which are often filled with gum even when no hyphae can be found.

In the Pavia district cases were observed in which 70 to 80 per

cent. of the variety Voghera showed the stunted form of the disease, whereas in other varieties only 10 to 15 per cent. were attacked, mostly by the true wilt.

The same fungus has been isolated from diseased eggplants (*Solanum melongena*).

This disease is stated to be very widely distributed in Italy and to be the most serious disease of chillies, since practically every field is infected. The losses are most serious (up to 90 per cent.) in the large fields cultivated without proper rotation, especially where the soil is dry and rich in humus. Small plots in which there is a long period between successive chilli crops suffer much less.

ZAPROMETOFF (N. G.). К вопросам развития и лечения грибных болезней Виноградной лозы в условиях Средней Азии. [On the development and control of fungal diseases of the Vine under the conditions obtaining in Middle Asia.]—Pamphlet of the *Uzbekistan Plant Protection Exper. Stat., Phytopath. Sect.*, Tashkent, 22 pp., 1925.

The vine-growing area in Middle Asia [see this *Review*, v, p. 174] may be roughly divided into the following three regions, in which the methods of cultivation differ widely: the Samarkand region, comprising the districts of Samarkand, Katta-Kourgan, and Khodjent, where the vine is kept low; the Tashkent region, where the vines are trained to form arches; and the Fergana region, where the vines are trained high up on poles and crossed over at the top from row to row to form dense pergolas. In the two first regions the vines are covered up for the winter, while in Fergana they remain open through the whole year, and the varieties of vine [all of local origin] also differ from region to region. In the Samarkand region the predominant disease is 'spotted anthracnose' (*Gloeosporium ampelophagum*); next comes the autumn green mould (*Cercospora vitiphylla* Barb. and *C. roesleri* Sacc.), while *Oidium* [*Uncinula necator*] is rare. In the Tashkent region all the three diseases are moderately represented. In Fergana *Oidium* is endemic and yearly causes very considerable losses to the crop, while the other two diseases are but of small importance. The prevalence of *Oidium* in the latter region is attributed chiefly to the abovementioned method of cultivation, as the density of the foliage on the top of the pergolas prevents adequate ventilation and insolation of the vines; moreover, conditions are rendered still more favourable for the development of the fungus by the custom of periodically flooding the vineyards during the summer for irrigation purposes, this creating a stagnant atmosphere, saturated with water vapour, inside the pergolas.

The rest of the paper gives a detailed review of the damage done in 1924 by vine diseases in the various districts, and a discussion of the most satisfactory control measures to employ against *Oidium* under local conditions.

MANUEL (H. L.). **Downy mildew of the Grape.**—*Agric. Gaz. New South Wales*, xxxvi, 10, pp. 751–752, 1 fig., 1925.

The weather conditions experienced in New South Wales during

the spring and summer of 1925 are stated to have been ideal for the development of downy mildew of the vine [*Plasmopara viticola*: see this *Review*, ii, p. 292], and it was noticeable that where spraying had been neglected the crops were very poor. In the Hunter River district the grape harvest was 70 per cent. short of expectations, mainly owing to the damage done by this disease, and the author believes that, in consequence of the neglect of many growers to spray their vineyards regularly, the total vintage figures for the State were reduced by 40 per cent.

STUMMER. **In Gaze eingebeutelte Trauben sind peronosporafest.** [Grapes protected by gauze bags are immune from *Peronospora*.]—*Zeitschr. für Pflanzenzüchtung*, x, 4, pp. 468-469, 1925.

It was observed at Klosterneuburg [Austria] in 1922 that grapes covered with parchment bags for hybridization purposes remained free from infection by *Botrytis* [*cinerea*]. In 1924 the inflorescences of Vinifera × Vinifera plants were wrapped in parchment immediately after fertilization, and this was replaced by gauze ('marquisette') bags as soon as the ovaries began to swell. Notwithstanding the virulence of the subsequent *Peronospora* [*Plasmopara viticola*] epidemic, the parts thus protected remained perfectly healthy even where the usual applications of copper sulphate were omitted. This is attributed partly to the purely physical avoidance of an obstacle by the air currents bearing the spores, and partly to the absence of dew inside the bags.

MONTEMARTINI (L.). **Rassegna fitopatologica per l'anno 1924.** [Phytopathological review for the year 1924.]—*Atti Ist. Bot. Univ. di Pavia*, Ser. 3, ii, pp. ix–xxiii, 1925.

Amongst the references of pathological interest included in this report, the following may be mentioned.

An unusually severe epidemic of fireblight of pears (*Bacillus amylovorus*) was reported almost simultaneously from the provinces of Pavia, Como, Ravenna, and Udine. Fruit, branches, and in one case the leaf petioles were affected. Damage to apple trees from the same cause was also observed in Pavia.

Vines suffered from attacks of bacteriosis (*Bacillus uvae*) in Voghera [Pavia]; from *Macrophoma peckiana* in Piacenza; and from *Aureobasidium vitis* var. *album* in Como.

Other diseases recorded include bacteriosis of sorghum (*Bacillus sorghi*) in Pavia and Ascoli-Piceno; *Trichosporium maydis* on maize in Pavia; wilt of chilli pepper (*Bacillus capsici*) in Caserta, Pavia, Ascoli-Piceno, and Teramo; *Rhizoctonia violacea* var. *asparagi* on roots of asparagus in Mantua; *Bacillus betae* and *B. bussei* on roots of sugar-beet in Piacenza; and *Exobasidium vexans* on leaves of tea plants in the Pavia Botanic Gardens.

Experiments in the fungicidal treatment of fruit trees with Ambrosio preparation during the dormant period gave good results with apples, pears, and vines. It possesses excellent adhesive properties and retains its value over a long period.

Notes sur les travaux poursuivis par les stations et laboratoires de l'Institut de Recherches Agronomiques en 1924. [Notes on the work carried out by the stations and laboratories of the Institute of Agricultural Research in 1924.]—*Ann. Sci. Agron.*, xlii, 5, pp. 327–390, 1925.

The following references to the phytopathological activities [other than those already noticed in this *Review*] of the various experimental stations and laboratories connected with the French Institute of Agricultural Research are of interest.

Detailed observations were made by Ducomet at Grignon on late blight of potatoes (*Phytophthora infestans*) with special reference to the date of attack. In the west the symptoms appeared earlier than in the vicinity of Paris. Much difficulty was experienced in the establishment of a scale of relative resistance and susceptibility to the disease. The correlation between the intensity of tuber and foliage attack, and between primary and secondary foci of infection, was not always apparent. The preservative action of Bordeaux mixture was found to extend over forty days or more. Tomatoes were not attacked until towards the end of the season, a fact which suggests the possible existence of a distinct biologic form of the fungus.

Cercospora concors [see this *Review*, iii, p. 421] has been found on potatoes in Belgium, and in the Vosges, Haute-Savoie, and Creuse.

Potato plants affected by wilt [see this *Review*, iii, p. 189] are stated to be uniformly characterized by the presence of *Vermicularia varians* [*Colletotrichum atramentarium*: see this *Review*, iv, p. 699; v, p. 124] on their roots. The connexion between dartrose and wilt, however, is by no means clear, the fungus occurring extensively at Grignon, where wilt is entirely absent.

The effects of the virus diseases of potatoes are stated to be much graver than is generally realized. In comparison with the four years immediately preceding the war, the average production in France, Belgium, and England during 1920–23 sank by 16, 10, and 2 per cent., respectively. An increase of 1 per cent. during the the corresponding period was shown in Norway; 2 per cent. in Switzerland and Denmark; 3 per cent. in Poland; 9 per cent. in Sweden; and 12 per cent. in Holland. These figures are believed to be largely correlated with the state of the crops in regard to the virus diseases.

The infectious character of leaf roll and 'frisolée' is stated to have been conclusively demonstrated. It has been shown that insulation and drought favour the occurrence of leaf roll, while mosaic is promoted by directly opposite conditions; and that 'frisolée' and mosaic are merely two distinct manifestations of the same disease. Cultivation at high altitudes has not proved an infallible remedy against degeneration [see also this *Review*, iv, p. 372] and selection can equally well be practised in the plains.

The black discoloration of wheat ears caused by *Dilophia graminis* [see this *Review*, iv, p. 409] has been studied. Inoculation experiments on young ears resulted in the development of the pycnidial stage [*Dilophospora alopecuri*]. The co-existence of the eelworm [*Tylenchus tritici*] with the fungus was found to be

frequent but not constant, and it was observed that the former was attracted to the latter.

The cause of the 'apoplexy' of apricots, which produced heavy losses in the Rhone Valley in 1924 [see also this *Review*, ii, p. 119], remains obscure. *Cytospora* was frequently observed on the dying trees. *Monilia* [*Sclerotinia laxa*: see this *Review*, i, p. 180] again caused serious damage, and the value of treatment with Bordeaux mixture or lime-sulphur was negligible.

The application during the dormant period of a solution of 15 per cent. ferrous sulphate to chlorotic peach trees was found to restore the normal colour of the foliage. Peach leaf curl (*Exoascus* [*Taphrina*] *deformans*) was adequately controlled by autumn applications of Bordeaux mixture.

WAHL (B.). **Bericht über die Tätigkeit der Bundesanstalt für Pflanzenschutz in Wien im Jahre 1924.** [Report on the activity of the Federal Institute for Plant Protection in Vienna in the year 1924.]—Reprinted from *Zeitschr. Landw. Versuchswesen in Deutschösterreich, 1925*, 28 pp., 1925.

This report, which has been prepared on similar lines to that for 1921 to 1923 [see this *Review*, iv, p. 144], contains the following references of phytopathological interest.

Wheat was attacked by foot rot (*Ophiobolus*) [*graminis*], *Fusarium culmorum* (especially Swedish varieties), and *Septoria tritici*.

Early and late blight of potatoes (*Macrosporium* [*Alternaria*] *solani* and *Phytophthora infestans*) were prevalent, and mosaic and leaf roll appear to have gained ground. The incidence of bacterial wet rot of the stored tubers was also high.

The cultivation of stone-fruit trees is stated to be seriously threatened by the steady increase in the prevalence of *Sclerotinia* rot, while apple and pear scab (*Venturia*) [*inaequalis* and *V. pirina*] are also spreading. Popular leaflets dealing with the symptoms and control of these two diseases were issued by the Institute (*Mitteilungen* 157 and 160) during 1924. Gooseberry mildew (*Sphaerotheca mors-uvae*) has been observed with increasing frequency in Viennese gardens.

Germisan, uspulun, and a Viennese preparation known as 'S' (not yet on the market) gave good results in the control of bunt on winter wheat [*Tilletia tritici* and *T. levis*]. In a test on the control of loose smut of oats [*Ustilago avenae*], in which Hohenheimer beize [urania] and segetan-neu were used in addition to the foregoing, the incidence of infection was as follows: control 16·2, uspulun 2·4, germisan 4·7, urania 5·8, segetan 8·7, and 'S' 11·1 per cent.

As in previous years, Bosna paste proved equal to Bordeaux mixture in the control of vine *Peronospora* [*Plasmopara viticola*], while kurtakol and nosperal (1 per cent.) gave less satisfactory results. Where Bosna paste was applied with a Rota generator, only traces of copper were found on treated apple and vine leaves and none on pear foliage.

KRASUCKI (A.). **Klęski rolnicze w Małopolsce a ochrona roślin.** [Agricultural calamities in Little Poland and plant protection.] —*Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], Warsaw, i, 1, pp. 23–31, 1925. [French summary.]

This paper deals chiefly with insect pests of agricultural crops in

Little Poland, and the only items of mycological interest are the information that in 1924, following a long and severe winter and a late spring, cereal crops, particularly oats, suffered to an exceptionally severe degree from attacks of various fungous diseases, and that heavy losses were caused in the sugar beet crop by *Cercospora beticola*.

Siemaszko (W.). **Notatki fitopatologiczne. II.** [Phytopathological notes. II.]—*Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], Warsaw, i, 2, pp. 40–43, 1925. [English summary.]

In 1924 a heavy outbreak of club-root of cabbage (*Plasmodiophora brassicae*) occurred in the neighbourhood of Koluszki [Poland] in a field where sporadic cases of the disease had been recorded in the preceding year. The author gives a brief popular description of the disease, and recommends the following control measures: drainage of the soil; crop rotation, excluding all cruciferous crops for four or five years; the destruction of all cruciferous weeds in infected fields; liming of the soil; and ordinary sanitary precautions to prevent infection of the seed-beds and fields. Some indications are also given regarding the temperature and soil moisture relations of the fungus.

Downy mildew of beet (*Peronospora schachtii*) was recorded on fodder beets for the first time in 1924 in the neighbourhood of Skierniewice. The attacked leaves turn yellow, become wrinkled, and curl at the margins, and they bear on their under side a greyish efflorescence consisting of the conidiophores of the fungus. Oospores are formed inside the leaf tissues. Control should consist in the selection of healthy plants for seed bearing [see this *Review*, iii, pp. 565, 729].

Leptostroma pinastri, the pycnidial stage of *Lophodermium pinastri*, appeared on pine seedlings in the Puszcra Bialowieska in February 1924. This early outbreak of the fungus is believed by the author to have been caused by a spell of mild weather which occurred at that time.

During the summer of 1924 caterpillars of *Mamestra brassicae* in the neighbourhood of Warsaw were heavily attacked by *Entomophthora sphaerosperma* [see this *Review*, v, p. 93], which formed a white efflorescence on the surface of the dead insects and fixed the latter to their supports. This fungus differs from *E. aulicae* Reich. by the size of the conidia, which are 15 to 26 by 5 to 8 μ in the former, and 27 to 38 by 18 to 27 μ in the latter.

Garbowski (L.). **Choroby i szkodniki roślin uprawnych w Wielkopolsce, na Pomorzu i na Śląsku w roku 1923.** [Diseases and pests of cultivated plants in Great Poland, Pomerania, and Silesia in 1923.]—Supplement to *Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], Warsaw, i, 2, 39 pp., 1925. [French summary.]

The present report is compiled on the same lines as the previous one [see this *Review*, iv, p. 19], and for the most part contains only information already noticed from other sources, or dealing with common crop diseases. Winter barley growing at the Bydgoszcz Station was attacked by *Typhula graminum* and *Ascochyta graminicola*.

Mitra (M.). **Report of the Imperial Mycologist.**—*Sci. Repts. Agric. Res. Inst. Pusa, 1924–25*, pp. 45–57, 1925.

The study of the influence of soil and fertilizer conditions on wilt of 'rahar' or pigeon pea (*Cajanus indicus*) [due to *Fusarium udum*: see this *Review*, iv, p. 331] was continued on the permanent manurial series of plots of the Pusa Farm [for an account of these plots see *Pusa Rept.* for 1922–23, p. 56]. The average number of wilted plants in the three plots receiving superphosphate every year was five times that in the five plots not receiving superphosphate. The number in the green-manured plot was only one-tenth of the average number in those same five plots, while that in the plot receiving both green manure and superphosphate was 1·7 times. It has again been demonstrated that the bulk of the infection originates in the soil, only a small proportion being carried by the seed. The incidence of wilt was found to bear no relation to the moisture content of the soil, which was recorded for each three inches down to a depth of 2 ft., in all the 14 permanent manurial plots on which the incidence of wilt is under study, four times during the season. This disposes of the idea that severe wilting is associated with water-logged soils. The hydrogen-ion concentration of the soil was found to be almost identical in all the plots and to vary very little during the season.

Young cinchona plants (*Cinchona ledgeriana*) in the Government plantation in Lower Burma were affected by a swelling of the collars to two or three times their normal diameter. The thickened bark showed a dark discoloration and extensive longitudinal cracking. The lower leaves fell, leaving only those at the extremity of the branches which were narrower than usual. Microscopic examination of the diseased tissue failed to reveal the presence of any causal organism and the disturbance is believed to be of physiological origin.

A fairly serious disease occurred in one of the Coimbatore sugarcane seedlings (Co. 213) and to a slight extent in another (Co. 210), recently introduced into Bihar. The symptoms closely resemble those of collar rot (*Hendersonina sacchari*), which is known to be the cause of a very similar disease in Assam, Coimbatore, and Mysore, in yellowing of the leaves, stunted growth, hollowing out of the pith, and lightness of the mature cane. The disease was prevalent on low lands, and it was found on examination of infected clumps that the root system was under-developed and some of the adventitious roots decayed. Various fungi, including one very like *H. sacchari*, were isolated from diseased canes.

Sugar-cane smut, due to *Ustilago scitaminea*, was observed on Co. 213 in Bihar, and growers were advised to destroy all smutted clumps. This fungus is also reported to be causing widespread damage in the Punjab.

A disease resembling mosaic and chlorosis has been observed in a good many of the Coimbatore seedling varieties of cane grown at Pusa, but hitherto the damage from this cause has been very slight.

One species each of *Fusarium*, *Vermicularia*, and *Rhizoctonia* has been isolated from dying bersim (*Trifolium alexandrinum*) plants. Inoculation experiments gave positive results only with

the *Rhizoctonia*, which killed 70 per cent. of the inoculated plants.

Inoculations and cross-inoculations were made with all the six strains of *Pythium* isolated from various Cucurbitaceae [loc. cit.], each of which was found to infect its particular host and those of the others. Together with *P. butleri*, they were also inoculated into papaya [*Carica papaya*], chilli [*Capsicum annum*], and tobacco [which are known host plants of *P. butleri*]. The six Cucurbitaceae strains were only feebly positive on chilli and tobacco and negative on papaya, while *P. butleri* was parasitic on all. All the strains were found to agree morphologically with *P. butleri*.

An investigation of potato diseases in the Khasi hills showed that the chief damage is caused by late blight (*Phytophthora infestans*). Storage rots caused by this fungus and by *Fusarium* were severe. Common scab (*Oospora* [*Actinomyces*] *scabies*), early blight (*Alternaria solani*), and *Corticium vagum* were also observed.

SAMUEL (G.). **Annual Report of the Lecturer on Plant Pathology.**—Reprinted from *Rept. Min. of Agric. S. Australia for the year ending 30th June, 1925,* 2 pp., 1925. [Received January, 1926.]

Weather conditions were favourable for the development of various fungous diseases during the year.

Take-all of wheat (*Ophiobolus cariceti*) [see below, p. 223] was again prevalent, especially on sandhills and on heavy soil tending to open up in the summer: barley grass [*Hordeum murinum*] was severely infected at Adelaide and elsewhere [see this *Review*, iv, p. 89].

Young orange seedlings in the Inman Valley were attacked by a fungus probably identical with *Ascochyta corticola* [see this *Review*, i, p. 291]. A number of trees were completely ring-barked, but cases in the earlier stages were successfully treated by the excision of the diseased tissue and painting with Bordeaux mixture.

Colletotrichum tabificum [*C. atramentarium*: see this *Review*, v, p. 124] caused a root rot of greenhouse tomatoes at Morphettville, this being the first record of the disease in South Australia. The most serious disease of tomatoes is the Australian spotted wilt [see this *Review*, iii, p. 307], which has lately invaded the greenhouses besides causing increasing losses in the field. There are stated to be numerous indications that this disease belongs to the virus group. A bacterial disease producing symptoms resembling those caused by *Bacterium* [*Aplanobacter*] *michiganense* [see this *Review*, ii, p. 347] was observed in tomatoes in July 1924. The plants recovered with the onset of warmer weather.

Cauliflowers at Campbelltown were attacked in July 1924 by *Peronospora parasitica*, which severely injured the leaves and prevented proper heading. The fungus was recorded for the first time in South Australia on cabbage seedlings in June of the same year. Probably this organism, like *Bact. campestre*, which was recorded on cauliflowers for the first time in April 1925, had long been present without attracting attention.

Beans in two localities were attacked by *Uromyces fabae*, this being the first record of the rust in the State.

HANSFORD (C. G.). **Report of the Microbiologist.**—*Ann. Rept. Dept. Sci. and Agric. Jamaica for the year ending 31st December, 1924*, pp. 21–23, 1925.

The following references of phytopathological interest, not already noticed from other sources, are included in this report.

In June 1923, a number of plants of the China banana (*Musa cavendishii*) were inoculated with the Panama disease organism [*Fusarium cubense*] and up to the time of writing they have shown themselves to be immune from the disease. Other diseases of bananas observed during the year were black spot (*Cercospora musarum*) and a leaf spot of undetermined cause found in a single locality. Inoculations with various fungi isolated from the spots in the latter case failed to reproduce the disease.

Tobacco was affected by a rot of the basal portion of the stem caused by a species of *Phytophthora*, while in other cases a similar disease was due to a species of *Rhizoctonia*. *Phytophthora* [*infestans*], *Alternaria solani*, and *Actinomyces scabies* were found on potatoes.

Elsewhere in the report (pp. 2–3) reference is made to the increase from 4,007 in 1923 to 6,698 in 1924 in the number of plants affected by the Panama disease of bananas detected and destroyed [see this *Review*, v, p. 111]. In certain areas the Gros Michel is clearly doomed, and some other, resistant, variety must be grown. In addition to the China variety, the Robusta, recently introduced from Central America, is known to be resistant to *F. cubense.* Both these varieties, however, are unpopular commercially. The China is inferior to Gros Michel in carrying power, only grows well on good land, the bunches are loose in habit, and the tips of the fruit subject to rotting. The Robusta, which is stated to be distinct from the Giant Fig [see this *Review*, iv, p. 296], appears to be closely similar to the Congo, which has proved a commercial failure in Costa Rica. Its fruit appears to be identical in texture and flavour with the ordinary banana of commerce, but the stem and skin are more delicate and subject to bruising. Experiments have shown that *M. cavendishii* is quite sterile and does not produce seeds even when fertilized with pollen from wild species, and as no disease-resistant strain of the Gros Michel has yet been obtained, the problem of finding a banana resistant to Panama disease and suitable for the market is regarded as a vital one for the industry as a whole. Soil sterilization with chemicals has proved unsuccessful against *F. cubense*, except where corrosive sublimate has been used in enormous quantities and at a prohibitive cost.

The campaign against mosaic disease of sugar-cane was continued. The two resistant canes, Mexican Striped and Badila, sent from Honolulu, have been propagated for trial on estates. Tests with half-bred 'Uba' canes and other mosaic-resistant varieties are in progress.

Work connected with insect and fungus pests and their control.—*Rept. Agric. Dept. St. Vincent for the year 1924*, pp. 16–25, 1925.

The following references of phytopathological interest are contained in this report (pp. 22–25).

The soft rot of cotton bolls due to *Phytophthora* sp. was prevalent during periods of high humidity and caused a loss of 25 per cent. of the bolls in some instances. Experiments in its control by spraying the soil with Burgundy mixture, on the assumption that the spores are carried over in the soil from one season to the next, gave certain indications of promise, but require to be repeated. In a few low-lying situations, especially where weeding had been neglected, cotton seedlings suffered severely from the attacks of *Sclerotium rolfsii*. The West Indian cotton leaf mildew (*Ovulariopsis gossypii*) continued to be prevalent late in the season.

Root disease of sugar-cane (attributed to *Marasmius sacchari*) occurred on an extensive scale in the island, especially on poor soils. The rind fungus (*Melanconium sacchari*) and pineapple disease (*Thielaviopsis paradoxa*) were also observed on this crop.

Leaf rust [*Puccinia arachidis*] was common on groundnuts nearing maturity, and a few cases of maize smut [*Ustilago zeae*] were reported.

CAMPBELL (J. G. C.). **Report by the Mycologist for the year 1924.**—*Ann. Rept. Fiji Dept. Agric. for the year 1924*, pp. 13–14, 1925.

Amongst the diseases recorded in this report, the first presented by a mycologist in the Fiji Islands, the following may be mentioned.

Coco-nuts were attacked by thread blight, believed to be caused by a species of *Corticium* [? *C. penicillatum*: see this *Review*, v, p. 136]; stem bleeding disease (*Thielaviopsis paradoxa*); leaf spot (*Pestalozzia palmarum*); and smut (*Graphiola cocoina*), which was also found on fan palms.

Pineapples were injured by *Thielaviopsis paradoxa*, and papaws suffered from fruit rot and dying-off of the trees associated with a species of *Phytophthora*.

Other records include tomato leaf spot (*Septoria lycopersici*); cacao black rot (? *Phytophthora faberi*); rot of citrus fruits due to *Penicillium* and *Phytophthora*; coffee rust (*Hemileia vastatrix*); cotton leaf spot (*Mycosphaerella gossypina*); and false smut of rice (*Ustilaginoidea virens*).

GARDNER (M. W.). **Indiana plant diseases, 1923.**—*Proc. Indiana Acad. Sci.*, xxxiv (*1924*), pp. 297–313, 1 fig., 1925.

This is the fifth of a series of annual reports recording the occurrence of plant diseases in Indiana [see this *Review*, iv, p. 23]. The climatic conditions of the year are discussed in relation to the prevalence of the various diseases. In addition to fruits, vegetables, and cereals, references are made to diseases of forest and shade trees and ornamental plants. As in the previous reports, the diseases are arranged alphabetically by hosts and bibliographical references are given. The following items of phytopathological interest, not already noticed from other sources, are included.

A severe epidemic of fireblight (*Bacillus amylovorus*), the worst that has occurred for several years, caused great damage to apple trees, especially Jonathans; pears also suffered considerably, though

less than apples. Sooty blotch (*Phyllachora pomigena*) was extremely severe as the cause of an objectionable blemish on apple fruit. Core mould (usually caused by a species of *Alternaria*) was fairly frequent in Delicious, Stayman, and Winesap apples, and is attributed to the short, open calyx tube that may be found in these varieties. *Alternaria* spots centred around the lenticels were observed in stored fruit.

Lima bean plants [*Phaseolus lunatus*] were attacked by a spot disease corresponding to the bacterial spot disease recently described in Wisconsin [and attributed to a new species, *Bacterium viridifaciens*: see this *Review*, iii, p. 124], but the author's cultural and cross-inoculation tests have established its identity with *Bacterium vignae* [see this *Review*, ii, p. 486]. Other hosts of this parasite are Adsuki bean [*Phaseolus angularis*], velvet bean [*Stizolobium deeringianum*], hyacinth bean [*Dolichos lablab*], and tick trefoil [*Desmodium* sp.].

Radishes were heavily attacked by black root caused by *Nematosporangium* [*Pythium*] *aphanidermatum*, to which the white Chinese variety is said to show some resistance.

Anthracnose of black raspberry [*Rubus occidentalis*], caused by *Plectodiscella veneta*, is stated to have frequently prevented cropping owing to the fact that the bearing canes were girdled and died just before the fruit matured.

Tobacco was attacked by blackfire (*Bacterium angulatum*), wildfire (*Bact. tabacum*), root rot (*Thielavia basicola*), frog-eye spot (*Cercospora nicotianae*), and mosaic. Inoculations by Kendrick with the virus of the destructive winter blight type of tomato mosaic [see this *Review*, iv, p. 708] are reported to have produced typical mosaic mottling and also a necrotic spotting on leaves of tobacco. Though most recent workers do not consider necrotic spots to be a symptom of tobacco mosaic, these experiments suggest that the earlier observations of Beijerinck and others in regard to their association with mosaic were well founded [see also above, p. 195].

RIVERA (V.). **Azione dei raggi X sopra i tumori vegetali.** [Action of X-rays on plant tumours.]—*Riv. de Biol.*, vii, 4–5, pp. 449–465, 4 figs., 1925. [Received January, 1926.]

Following up the work of Gosset, Magrou, and their colleagues [see this *Review*, iv, p. 25] on the irradiation of plant tumours, the author carried out a series of experiments which are here described at greater length than in his paper already noticed from another source [see this *Review*, v, p. 82].

LEVINE (M.). **Morphological changes in Bacterium tumefaciens.** —*Science*, N.S., lxii, 1610, p. 424, 1925.

In a study on the crown gall organism, *Bacterium tumefaciens*, daily smears from cultures were made over a period of 72 days. A two-days-old culture shows long rods, which not infrequently are beaded in appearance. These rods later break up until (after 20 days or less) they are replaced by small, faintly straining cocci, with occasional slender bacilli. The zoogloeal mass appears to increase

with the age of the culture and the cocci seem to disappear, a smear from a three-months-old culture showing an amorphous mass of jelly-like substance, with occasional deeply stained, minute, spherical bodies. It is thought that the variation in the size of the organism recorded by different observers may be due to the age of the culture not having been considered.

In a large number of the cultures, numerous small, lenticular bodies appear, equal in length to, but rather wider than the rods. These bodies stain deeply at each end, whilst the centre fails to colour. They are considered to be spores. When transferred to fresh media they give rise to new rod-like bodies.

MAINS (E. B.). **Observations concerning the disease susceptibility of cereals and wild grasses.**—*Proc. Indiana Acad. Sci.*, xxxiv (*1924*), pp. 289–295, 3 figs., 1925.

Notes are given of the author's observations during the past two years on varietal susceptibility to disease in various cereals and wild grasses.

In 1923, crown rust of oats (*Puccinia coronata*) [*P. lolii*] was very severe at the Purdue Agricultural Experiment Station. The varieties Iogren and Ohio 201 were resistant, while Iowa 103, Irish Victor, Miami, and Cornellian were only moderately infected. In 1924, a leaf spot due to *Helminthosporium avenae* caused heavy damage, to which Minota and Minnesota 358 were highly resistant, while only a slight amount of infection occurred on Silvermine, Ohio 201 and 202, Cornellian, Irish Victor, Kanota, Fulghum, and White Cross.

In connexion with some studies on rye diseases, developing sporophores of ergot (*Claviceps purpurea*) contained in pots infected a nursery containing a number of varieties of winter and spring wheat and barley, and a garden with many wild grass species. The heaviest infection was observed on the Yeoman C.I. 6223 variety of wheat, while Wisconsin Wonder and Warden C.I. 4994 were also severely attacked. Among the barleys, Kitzing C.I. 189 and Princess C.I. 1428 showed heavy infection. The occurrence of this disease on wheat and barley is stated to be somewhat unusual in Indiana. Very heavy infection was observed on the following wild grasses: *Dactylis glomerata, Bromus marginatus, B. secalinus, B. inermis, Agropyron cristatum, A. inerme, A. repens, A. smithii, Hystrix hystrix*, and *Elymus condensatus*.

In the spring of 1924, considerable differences in varietal susceptibility to scab [*Gibberella saubinetii*] were noted among a number of spring wheat varieties. Very heavy infection occurred on Marquis, Sbei C.I. 4588, and C.I. 3142, 3747, and 3756; heavy on Yaraslov C.I. 1526, three strains of Arnautka, Velvet Don, two strains of Kubanka, two strains of Polish, and eleven others; and slight on seventeen, including Norka C.I. 4377, Khapli C.I. 4013, three strains of Emmer, Bearded Spelt C.I. 1774, two strains of Dixon, Yeoman C.I. 6223, Blount's Lambrigg C.I. 5021, Glaicia C.I. 2463, Red Resaca C.I. 6391, and Huron C.I. 2315.

In 1923 several clumps of *Festuca capillata* began to die off, and the damage steadily increased during the summer. From the

affected stems and leaves a species of *Marasmius* developed, closely resembling *M. interstitians* [see also this *Review*, iv, p. 474].

GUYOT (L.). **Les maladies bactériennes chez les Graminées.** [Bacterial diseases of Gramineae.]—*Rev. de Bot. Appliquée*, v, 52, pp. 920–925, 1925.

This is a list, together with brief descriptions of the symptoms and some bibliographical references, of the bacterial diseases recorded in various parts of the world on maize, sorghum, and other cereals, and also on sugar-cane.

Investigación sobre pérdidas de la cosecha de Trigo en las Provincias de Santa Fe y Córdoba. [Investigations as to the losses in Wheat yield in the Provinces of Santa Fe and Córdoba.]—*Min. Agric. Nac. (Buenos Aires), Secc. Prop. e Inform. Circ.* 557, pp. 815–818, 1925.

As a result of the unusual meteorological conditions in 1925, the wheat crop in the provinces of Santa Fe and Córdoba (Argentine Republic) sustained very considerable damage from rust, which was the chief cause of a disastrous harvest, in spite of the fact that the heavy rains had produced a most luxuriant growth and led to expectations of a bumper crop. This excessive vegetative growth seems, indeed, to have favoured the rust attacks.

Puccinia triticina ordinarily causes more damage in the Argentine than *P. graminis tritici*, and efforts have been concentrated on obtaining varieties immune from attack by this species, such as the hybrid Chino-Barleta No. 38, which has given very satisfactory results. In 1925, however, the meteorological conditions in Córdoba and Santa Fe (high rainfall, late frosts, unusually warm showers at flowering time, and hot winds later) led to a severe outbreak of the black rust (*P. graminis*), which spread rapidly and with extreme virulence, such as has not previously been experienced in the country. This rust appears ordinarily in October in the Argentine while *P. triticina* develops in September, and in normal years the former is too late to do much damage. The low yields of last season (average under 500 kg. per hect. harvested), while primarily due to rust, were in part the result of the unfavourable weather conditions during the formation of the ears referred to above.

v. CARON-ELDINGEN. **Der Rostbefall des Weizens in Jahre 1925.** [The incidence of rust on Wheat in the year 1925.]—*Deutsche Landw. Presse*, lii, 38, p. 450, 1925.

The damage caused by yellow, and to a lesser extent, brown rust of wheat [*Puccinia glumarum* and *P. triticina*] in Germany is stated to have been more severe in 1925 than at any time during the last fifteen or twenty years.

The long periods of drought in Germany in the summer of 1925 would not have been expected to favour the development of the fungus, but evidently the four or five days' wet and stormy weather during the latter part of June provided the necessary conditions for an extremely sudden outbreak of the disease. The subsequent drought failed to check the spread of infection. Even the highly resistant Heil's Dickkopf and a number of other selected varieties

were severely attacked, only one of the writer's selections remaining immune.

The amount of damage to the crop appears to be correlated exclusively with the time of attack [see also this *Review*, iv, pp. 657, 658]. When this occurs before flowering the crop is partially or wholly destroyed. No loss need be anticipated when infection is delayed till ten days or a fortnight after flowering.

KIGHTLINGER (C. V.). **Preliminary studies on the control of cereal rusts by dusting.**—*Phytopath.*, xv, 10, pp. 611–613, 1925.

During 1924 experiments were conducted to determine the value of sulphur in the prevention of rust infection of cereals [see also this *Review*, v, p. 150]. After numerous laboratory tests on the inhibitory effect of several sulphur dusts on the germination of the uredospores of *Puccinia coronata* [*P. lolii*], it was decided to use 90–10 sulphur-lead arsenate dust.

In greenhouse tests with 2,071 oat plants infected by *P. lolii* and *P. graminis avenae*, the 1,057 dusted plants showed only two sori as compared with 4,517 in the 1,014 untreated individuals.

In a field test, six out of thirteen plots of oats were dusted four, five, or seven times. A count of infected versus healthy plants in plot (3), control, and (4), dusted seven times, revealed the striking efficacy of the dust, the percentage of leaves infected being 0·03 in the latter and 74·35 in the former. The percentage of infected leaves in the five central rows of each plot ranged from 0·00 in the plot dusted seven times to 99·14 in one of those receiving no treatment.

STAKMAN (E. C.), LEVINE (M. N.), & GRIFFEE (F.). **Webster, a common Wheat resistant to black stem rust.**—*Phytopath.*, xv, 11, pp. 691–698, 1 fig., 1925.

Webster, C.I. 3780, a recently named variety of common wheat (*Triticum vulgare*), appears to be resistant to more physiological forms of *Puccinia graminis tritici* than any other common wheat now known. It is an awned, hard red spring variety, the resistance of which was first observed in South Dakota in 1917. Webster has been inoculated with 19 physiological forms of *P. graminis tritici*, to all of which it is relatively resistant. No other variety of common wheat is known to be resistant to five of these forms. The rust resistance of Webster is apparently due to the large amount of sclerenchyma in proportion to collenchyma in the stem. It seems probable that it will also prove resistant to the remaining 20 physiological forms of *P. graminis tritici* found in North America, to three of which no *vulgare* wheat is known to be resistant. If so, it will be possible to use *vulgare* wheats entirely as parents in crosses for rust resistance, instead of resorting to durum and emmer varieties, which are unsuitable for this purpose on account of chromosome incompatibility and consequent high percentage of sterility [see also this *Review*, iv, p. 532]. Webster has 42 chromosomes in the somatic cells and is therefore classed as a common wheat, although the spike is somewhat spelt-like and the glume has a well-developed keel.

GREGORY (C. T.). **The loose and stinking smuts in Indiana.**—*Proc. Indiana Acad. Sci.*, xxxiv (*1924*), pp. 285–288, 1 fig., 1925.

Exceptionally severe losses (double the average) were caused throughout Indiana in 1924 by loose smut of wheat [*Ustilago tritici*]. Considerable evidence was obtained of the efficacy of the hot water treatment [see this *Review*, iii, p. 712] in the control of this disease. In only one out of sixteen fields in which Michikoff wheat was grown from treated seed distributed from the Purdue Experiment Station in 1920 was there more than 0·5 per cent. of infection in 1924. Similar data are stated to be available in the case of certified Michigan Amber, Ruby, Poole, and Fultz. Certain sudden cases of an increase in the amount of loose smut in certified wheat that have been observed emphasize the necessity of cultivation at a distance from infected fields.

Various instances of injury to the seed from hot water treatment are cited. In 1922 a batch of seed was treated on 5th October and sowing was postponed until the 15th, owing to wet weather. Only 25 per cent. of the treated seed germinated, and on examination of the remainder every grain was found to be mouldy.

Bunt [*Tilletia levis*] was extremely severe during 1923 and 1924. In the former year, the smut spore dust caused an explosion in a threshing machine. Farmers in various localities reported market price reductions of 5 to 50 cents per bushel owing to the disease, and in some cases the wheat was rejected. Excellent control was obtained by treatment with copper carbonate dust at the rate of 3 oz. per bushel. The various types of apparatus for, and certain other features of, the treatment are briefly discussed.

VERMOREL (V.). **Le vitriolage des semences, son remplacement par le verdissage pour préserver les Blés de la carie.** [The substitution of copper acetate for copper sulphate in seed treatment for the control of bunt of Wheat.]—*Comptes Rendus Acad. d'Agric. de France*, xi, 32, pp. 885–892, 1925.

The writer's experiments [the technique of which is briefly described] in the control of bunt of wheat (*Tilletia caries*) [*T. tritici* and *T. levis*] by copper acetate [see this *Review*, iv, p. 33] have been continued. The compound was employed both in a liquid and a dry form, and in each case copper sulphate was used for comparison.

Very little difference was observed between the action of copper acetate and copper sulphate in solutions of 0·5 to 2 per cent. on the germination of the spores. The efficacy of the treatment was found to increase with the duration of contact, the 0·5 per cent. solution, which was only slightly effectual after 20 minutes, completely inhibiting spore germination at the end of an hour. When the spores were rinsed after 5 minutes' contact with the 1 and 2 per cent. solutions, and 20 or 40 minutes at 0·5 per cent., some germination occurred, but where rinsing was omitted none of the spores germinated after 5 minutes.

Dusting with copper acetate or copper carbonate at the rate of 0·15 per cent. of the weight of the seed gave complete control of

infection. Preference is given to the former, which is stated to be more readily obtainable and more easily manipulated than the latter, besides causing less injury to the seed and to the subsequent development of the stand. Brief directions are given for the application of the dust, which should be used at the rate of 150 gm. per 100 kg. of seed.

POUZIN (P.). **Encore le traitement à sec des semences.** [Further notes on the dry method of seed treatment.]—*Journ. d'Agric. Prat.*, lxxxix, 45, pp. 378-379, 2 figs., 1925.

In continuation of his previous experiments in dusting wheat seed for the control of bunt [*Tilletia tritici* and *T. levis*: see this *Review*, iv, p. 34], the writer has successfully utilized anhydrous copper sulphate and a preparation known as vitrioline (Schloesing, Marseilles), which appears to satisfy all the requisite conditions at a moderate cost (4 francs per kg.). Anhydrous copper sulphate, mixed with half its weight of wood ash, ground lime, or dephosphorated slag, has also been used. The commercial brands of copper sulphate, including that designated as 'snow', are not recommended. In default of a special apparatus, the copper sulphate should be dried in an oven at a temperature of about 200° C. and the resulting dust applied at the rate of 100 to 300 gm. per kg. of seed. Brief directions for treatment are given.

KRAUSS (J.). **Beitrag zur Frage der Trockenbeize.** [Contribution to the dusting problem.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, v, 11, pp. 87–88, 1925.

Experiments have been carried out at the Hohenheim Plant Protection Institute with a view to discovering a dry seed treatment for the control of bunt of wheat [*Tilletia tritici* and *T. levis*] which should combine efficiency with reasonable economy in use.

The application of a mixture consisting of 1 part of paraform [paraformaldehyde] and 4 parts of finely ground calcined or dry slaked lime, at the rate of 150 gm. per cwt. of seed, gave a marked stimulus to germination, but it was observed that the slightest delay in sowing after treatment led to a great reduction in yield. In one plot the grain yield of seed stored for 20 days after treatment was only 59 per cent. of that in the control plot. Similar effects are to be feared where the seed is sown in very dry soil or exceptionally late in the year [see also this *Review*, i, p. 26].

TISDALE (W. H.), TAYLOR (J. W.), LEUKEL (R. W.), & GRIFFITHS (MARION A.). **New seed disinfectants for the control of bunt of Wheat and the smuts of Oats and Barley.**—*Phytopath.*, xv, 11, pp. 651–676, 4 pl., 1925.

The results of four years' experiments carried out at Arlington, Virginia, and Manhattan, Kansas, in the control of bunt of wheat [*Tilletia levis*], loose and covered smut of oats [*Ustilago avenae* and *U. levis*], and loose and covered smut of barley [*U. nuda* and *U. hordei*], with a number of new seed disinfectants, are described in considerable detail, and also presented in tabular form.

In the preliminary tests copper carbonate dust gave excellent control of bunt and improved the yield of the wheat crops. Against

the smuts of oats and barley it was less successful. Among the more promising of the mercury compounds used in these tests were chlorophol, corona No. 620, germisan, semesan, and uspulun.

The more efficacious compounds were further tested in fortieth-acre plots, in which copper carbonate again gave the best control of bunt besides stimulating germination and increasing the yield. Some of the liquid mercury treatments also gave very satisfactory results, but their use is not considered practicable in view of the efficacy, economy, and ease of manipulation of the copper carbonate treatment.

None of the dusts gave adequate control of the oat and barley smuts, and formaldehyde (1 in 320) remains the most effective liquid treatment against the former diseases. Chlorophol, corona No. 620, germisan, uspulun, and semesan all proved superior to formaldehyde in the control of the barley smuts, besides stimulating germination and increasing yield. These materials are more expensive than formaldehyde and involve some risk to stock fed with the treated grain.

KRAUSS (J.). **Nachdosierung von quecksilberhaltigen Beizmitteln für Getreide.** [Replenishment of mercurial disinfectants for cereals.]—*Zeitschr. Angew. Chem.*, xxxviii, 48, pp. 1088–1091, 1925.

Tests were carried out at the Württemberg Plant Protection Institute to determine the requisite concentration at which solutions of germisan, uspulun, and urania [formerly known as Hohenheimer beize] must be added to bring the concentration of a solution in which cereal seed grain has been steeped up to the original strength for further use [see also this *Review*, iv, p. 492]. Full details of the experimental technique are given, and the results are presented in tabular form.

Germisan and uspulun are stated both to contain 17·5 per cent. of mercury, compared with only 6 per cent. in the case of urania. It was shown that after 30 minutes' immersion in a 0·25 per cent. solution at the rate of 2 l. per kg. of grain, the bulk of the solution must be made up with a 0·65 per cent. solution of uspulun, 0·57 per cent. of germisan, and 0·52 per cent. of urania, in order to obtain the original concentration. After five minutes' immersion in a 0·25 per cent. solution, the amount of mercury adsorbed by the grain was found to be 83 per cent. with uspulun, 79 per cent. with germisan, and 55 per cent. with urania of that adsorbed in half an hour, which amounted to 81, 90, and 91 per cent., respectively, of that adsorbed in one hour.

McKINNEY (H. H.). **Foot-rot diseases of Wheat in America.**—*U.S. Dept. of Agric. Bull.* 1347, 40 pp., 6 pl. (1 col.), 2 figs., 1 graph, 2 maps, 1925.

The foot rot diseases of wheat, a term used to cover any basal rot of wheat plants after they have passed the seedling stage, are stated to be rather widespread in America, where they cause crop losses of economic importance in several of the principal wheat districts. The writer's studies on the problems connected with these diseases have convinced him that careful consideration should be given to

Bolley's suggestion (*North Dakota Agric. Exper. Stat. Bull.* 107, 1913) that the low yield in many of the chief wheat-growing districts is not primarily correlated with low soil fertility, the prevalence of injurious soil fungi being probably, in many cases, the limiting factor.

A full discussion is given of the foot rot caused by *Ophiobolus graminis* [see this *Review*, i, p. 381; v, p. 26], which is known to occur in many parts of the United States, as well as in Europe, Australia, and Japan.

As the problem of nomenclature of this foot rot fungus now stands, it appears that ascus-bearing type material of *O. eucryptus* (Berk. and Br.) Sacc. and *O. cariceti* (Berk. and Br.) Sacc. is no longer in existence, and therefore the original descriptions and drawings of these species are the sole means of identification. On this basis and on that of Saccardo's description of *O. graminis*, it seems reasonable to conclude that all three species are distinct. Since the species identified by the writer and other workers [loc. cit.] as the cause of foot rot agrees in its essentials with Saccardo's description, the name *O. graminis* is retained.

It has been found that the frequently smooth pycnidia of *Wojnowicia graminis* are in many cases indistinguishable from the perithecia of *O. graminis*, both with respect to form and position on the host [see this *Review*, iv, pp. 88, 662]. The writer knows of no published description whereby these organs can be distinguished with certainty, and all his observations indicate that any attempt to identify *O. graminis* on the basis of the perithecia alone, unless the contents are examined microscopically, is likely to cause confusion.

Helminthosporium sativum [see this *Review*, iii, p. 65; iv, p. 407] is widespread in the United States throughout the winter and spring wheat regions. The foot rot caused by this organism is described in detail.

During the past five years a foot rot, which appears to be distinct from, or to be a very unusual manifestation of, that caused by *O. graminis*, has been observed in Washington, Oregon, and California. Of the two predominant fungi isolated from the tissues of diseased plants in the two first-named States, one resembles *W. graminis* and the other *Leptosphaeria herpotrichoides* [see this *Review*, iii, p. 579; iv, p. 662]. The general appearance of the diseased plants is similar to that of those affected by *O. graminis*, but the discoloration of the culm bases and roots extends farther up the stems and is brown rather than black, though not so pale as in the case of infection by *H. sativum*. The new foot rot causes a collapse of the cells at the base of the culms, resulting in breaking of the stems and general lodging of the plants in infected areas.

Other fungi capable of causing foot rot include *Sclerotium rhizodes* [see this *Review*, iii, p. 267]; *Rhizoctonia* sp.; *Helminthosporium* spp.; and *H. tetramera* n. sp., which was found associated with a foot rot of winter wheat in Oklahoma in the spring of 1923. The simple or compound conidiophores of the new species are dark olivaceous to brown, with septa 5 to 50 μ apart, producing, at irregular distances from their bases, chiefly four-celled, dark olivaceous to brown, symmetrical conidia, measuring on an average 30·6

by 13·6 μ, borne in clusters of two or three to over fifty. On potato-glucose agar the fungus forms numerous long, simple or branched sclerotia, consisting of a hard, white pseudoparenchyma with an outer black rind, from which many hyphal strands develop.

Gibberella saubinetii [see this *Review*, ii, p. 536; iii, p. 201] has not been found by the writer associated with a true foot rot as distinct from seedling blight.

MELHUS (I. E.) & VAN HALTERN (F.). **Sclerospora on Corn in America.**—*Phytopath.*, xv, 11, pp. 724–725, 1925.

Sclerospora graminicola (Sacc.) Schroet. is stated to be very prevalent in Iowa on green foxtail (*Setaria viridis*) [see this *Review*, iv, p. 398]. Experiments in the inoculation of maize with the downy mildew from this host gave positive results on dent, sugar, flint, and pop varieties (the last-named being the most susceptible), infection occurring before the emergence of the plumule from the soil. In many cases 90 per cent. of the plants used in the tests contracted the disease. Two varieties of millet (*S. italica* and *Panicum miliaceum*) and teosinte (*Euchlaena mexicana*) also proved susceptible.

Some of the symptoms on green foxtail and on maize differ markedly. On the latter a greyish blotching and mottling may extend throughout the plant, while in other cases only a few mottled yellow spots or intervascular longitudinal stripes develop. Irregular, isolated spots, one-quarter to several inches in length, often develop rapidly in apparently healthy seedlings. The symptoms usually appear within ten days after the emergence of the plumule, but they may not develop for three weeks. Diseased plants are nearly always stunted and some die when only three inches tall, while others develop a bushy, stocky appearance due to the production of the normal number of leaves on a stalk with shortened internodes. This dwarfing closely resembles that described by Weston as due to *S. philippinensis* [see this *Review*, i, pp. 40, 169]. Conidial sporulation is somewhat sparse on maize, while oospores have never been observed on this host. The heaviest sporulation on maize is much less than the average on *S. viridis*, and occurs only in the seedling stage.

Soil from a field where downy mildew was abundant on *S. viridis* in the previous year proved infectious when foxtail was grown in it. The oospores evidently overwinter in the soil and infect the germinating seed in early spring, further spread probably taking place by means of the conidia. There are indications that the oospores remain viable in the soil for long periods, so that successive crops of foxtail may be infected from this source as well as by the conidia.

IMMER (F. R.) & CHRISTENSEN (J. J.). **The reaction of selfed lines and crosses of Maize to Ustilago zeae.**—*Phytopath.*, xv, 11, pp. 699–707, 1925.

Previous investigations have shown [see this *Review*, iii, p. 716; iv, p. 602] that selection in self-fertilized lines can be used to isolate lines of maize which vary considerably in their mode of reaction to

Ustilago zeae. In the present paper the results are reported of a study on the manner of reaction to smut in the F_1 and F_2 generations and in back-crosses, where selfed lines of known inheritance were used as parents.

The probable error method was used to determine what differences could be considered significant. The probable error in percentage decreased uniformly with the percentage of smut infection in the systematically replicated plots. For the entire experiment the probable error was 17·1 per cent.

The parent lines developed a uniform percentage of smut from year to year (1922–24 inclusive). The factors determining resistance or susceptibility were transmitted in the same way in both male and female gametes. There was no indication of dominance or susceptibility to smut reaction, and further studies are necessary to determine how many factors are involved [see also this *Review*, iv, p. 537]. Low smut strains selected under normal field conditions should be tested in an epidemic in order to confirm their resistance.

The inheritance of 'firing' (a condition characterized by desiccation of the leaves, especially at the tips, and the appearance of long, slender blotches apparently following the vascular bundles) can be adequately explained on the basis of a single factor. There was no apparent correlation between smut and firing.

KOEHLER (B.) & PETTINGER (N. A.). **Diseases in Illinois seed Corn as found in the Fifth Utility Corn Show.**—*Illinois Agric. Exper. Stat. Circ.* 299, 8 pp., 3 figs., 1925.

Tabulated data are given on the diseases of maize seed grain in the northern, central, and southern sections of the State of Illinois, based on a study of the germination records of the samples shown at the Fifth Utility Corn Show at Urbana in 1925. Scutellum rot [see this *Review*, iv, p. 665] was found to be the most prevalent disease, and a close relationship appears to exist between susceptibility to it and a soft, starchy endosperm. If this is the case, selection for horny kernels should lessen the amount of infection. This does not, however, apply to infection by *Diplodia zeae*, which occurred more frequently in the yellow maize with a horny endosperm than in the white samples, but was the least prevalent of all the diseases on the whole.

Other diseases identified were those due to *Cephalosporium acremonium*, *Fusarium moniliforme*, and *Gibberella saubinetii*, which occurred in the order given, in the north and centre of the State, while in the south *F. moniliforme* was next to scutellum rot in prevalence and was followed by *C. acremonium*.

KOEHLER (B.), DUNGAN (G. H.), & HOLBERT (J. R.). **Factors influencing lodging in Corn.**—*Illinois Agric. Exper. Stat. Bull.* 266, pp. 311–371, 19 figs., 5 graphs, 1 diag., 1925. [Received January, 1926.]

In connexion with a study on lodging in maize, it was ascertained by seed infection and inoculation experiments [the results of which are fully discussed and presented in tabular form] that increases in the percentage of leaning stalks (i. e., those inclining 30 degrees or

more) occurred when the seed was infected with *Diplodia zeae*, when starchy seed susceptible to scutellum rot [see last abstract] was used, or when the seed was naturally infected or artificially inoculated with *Gibberella saubinetii* [see also this *Review*, iv, p. 665]. On the other hand, no significant increases in the number of leaning plants occurred when seed was infected with *Cephalosporium acremonium* or *Fusarium moniliforme*, and the increases were doubtful when horny seed susceptible to scutellum rot was used.

Increases in the percentage of broken stalks due to seed infection occurred only when seed was infected with *C. acremonium* or when starchy seed susceptible to scutellum rot was used.

HUMPHREY (H. B.) & TAPKE (V. F.). **The loose smut of Rye (Ustilago tritici).**—*Phytopath.*, xv, 10, pp. 598–606, 3 figs., 1925.

The occurrence of loose smut in rye was first observed in North Dakota in 1913 (*Journ. Washington Acad. Sci.*, iv, p. 384, 1914), since when it has appeared in a number of States. So far, however, the disease has assumed no economic importance.

Comparative cultural and microscopic studies of this smut and loose smut of wheat (*Ustilago tritici*) failed to reveal any difference between them. The reaction of the rye plant to infection is also similar to that of wheat, except that in the former case the total destruction of a part (frequently the lower third or half) of the head is the rule, while in the latter all the florets are usually killed.

Cross-inoculation experiments [the details of which are given] in which heads of both wheat and rye were inoculated with spores of loose smut from rye and wheat, respectively, gave further proof of the identity of the two smuts.

Of the thirteen varieties and selections tested, only two were found to be susceptible, namely, Rosen (C.I. 195) and Rimpau (C.I. 126).

Enfermedad de los Naranjos. [Disease of Oranges.]—*Bol. Agric. Indus. y Com. Guatemala*, iv, 5, pp. 159–160, 1925.

A brief description is given of the symptoms of gummosis [see this *Review*, iv, p. 276], which is stated to be widespread in Guatemala on widely divergent types of soil. Bitter oranges [*Citrus bigaradia*] are resistant to the disease and may safely be used as stocks for grafting. Brief directions are given for its control by means of thorough aeration of the soil; exposure of diseased roots to the air for several days, and subsequent admixture of ground bonemeal or superphosphate with the soil used to cover them; removal of all infected material; and the application of dilute carbolic acid or 8 per cent. copper sulphate to the bark of the trunk and branches, followed by painting with tar.

WILTSHIRE (S. P.). **The wither-tip disease of Limes.**—*Kew Bull. Misc. Inform.*, *1925*, 10, pp. 401–403, 2 pl., 1925.

The wither-tip disease of limes caused by *Gloeosporium limetticolum* [see this *Review*, v, p. 89], which was first recorded in the

island of Dominica in 1922, when it was confined to a small area in the south, has since spread all over the island, and is stated to be now seriously threatening the lime-growing industry there. A brief description is given of the symptoms caused by the attacks of the fungus on the young shoots, leaves, blossoms, and fruits, these being clearly illustrated in the three accompanying photographs.

SIMMONDS (H. W.). **Pests and diseases of the Coconut Palm in the Islands of the Southern Pacific.**—*Fiji Dept. Agric. Bull.*, 16, 31 pp., 4 pl., 1925.

On pp. 26–29 of this bulletin the author, after acknowledging the help of Mr. J. G. C. Campbell, Mycologist, Fiji, in their compilation, gives notes on some of the principal fungous diseases of coconuts in the islands.

Coco-nut bud rot, recorded from various parts of Fiji and from Tonga, is considered to be due to *Phytophthora faberi*, which also causes a disease of papaws and the black pod of cacao.

The fungus *Thielaviopsis paradoxa* is the cause of the stem bleeding disease, the first symptom of which is a reddish-brown exudation (which turns black on drying) from cracks in the surface of the trunk. On examination, the inside of the affected portion is found to be soft, decayed, and yellowish in colour.

The unnamed leaf spot disease occurring in New Britain, the Solomon Islands, and New Hebrides [see this *Review*, iv, p. 35] has recently been found in Fiji, and is believed to be allied to the thread blights [see also p. 215 above]. Like bud rot it occurs in wet and badly drained situations, where it sometimes does much damage, causing a considerable amount of the nuts to fall.

Other diseases, not causing serious damage, are leaf spot (*Pestalozzia palmarum*) in Fiji; a grey blight similar to *Pestalozzia*, prevalent in the Solomon Islands; a rot resembling stem bleeding disease but with a wet instead of a dry internal lesion, occurring on Vanualevu; and *Graphiola cocotis* [*G. cocoina*], characterized by the formation of small, raised, black pustules, surrounded by a pale yellow ring, on the upper surface of the leaf. The latter disease is fairly common in Tahiti and occasionally seen in Fiji.

COOK (M. T.). **Enfermedades del Algodón en Puerto Rico.** [Cotton diseases in Porto Rico.]—*Rev. Agric. Puerto Rico*, xv, 6, pp. 300–301, 1925.

This is an enumeration of the diseases that have been so far recorded as occurring on cotton in Porto Rico, namely, leaf spot (*Cercospora gossypina*), areolate mildew (*Ramularia areola*), rust (*Kuehneola gossypii*), anthracnose (*Glomerella gossypii*), boll rot (*Diplodia gossypina* and *Fusarium* sp.), and root diseases due to *Fusarium* sp. and *Sclerotium rolfsii*. In each case a brief description of the symptoms is given. This list is compiled in view of the growing interest in the cultivation of cotton in the island, and a warning is given of the possibility of the introduction of other diseases from abroad, especially from the Antilles and the United States.

Krasucki (A.). **Blyszczka gamma (Plusia gamma L.), szkodnik roślin uprawnych i masowy jej pojaw w roku 1922.** [The owlet-moth (*Plusia gamma* L.), a pest of cultivated plants, and its epidemic occurrence in 1922.]—*Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], Warsaw, i, 3, pp. 1–12, 1925. [German summary.]

The owlet-moth (*Plusia* [*Phytometra*] *gamma*) was exceedingly destructive in 1922 in the south-east of Poland, particularly in sugar beet fields. Its ravages were, however, rapidly and efficiently checked by a severe epidemic of a fungous disease, due apparently to *Tarichium megaspermum* [*Entomophthora megasperma*: see this *Review*, i, p. 392], which attacked and killed almost all the caterpillars as soon as they appeared.

The attacked caterpillars at first turned yellow, more particularly on the ventral side, and then dark grey. The skin was wrinkled and loose, the body soft and flabby, and the caterpillars sluggish in their movements. The dead caterpillars were deformed, extended, and blackened. The skin, when rubbed between the fingers, broke up into a black powder, while the interior was either entirely dried up, or contained only a small quantity of a dark brown, pus-like matter. For the most part, the diseased caterpillars hung on the under side of the leaves, occasionally attached to the latter by threads, an indication that the fungus killed them while they were beginning to spin their cocoons. In the laboratory, the disease was observed to kill the infected caterpillars within 24 hours from the appearance of the first symptoms.

In 1923 the moth again appeared in the same localities, but in very small numbers. The few specimens of caterpillars collected and kept in the laboratory developed a disease somewhat differing in its symptoms from that described above. The skin turned yellow and collapsed as if the interior of the body were empty. On the surface, chiefly on the dorsal side, appeared blackish spots which did not extend over the whole body. The dead caterpillars were characteristically stretched out. In one specimen, which was studied more closely, the body was filled with a greenish, rather fluid, pus-like matter, containing (besides fatty particles, bacteria, and tissue detritus) short, thick, and irregularly shaped mycelial bodies. A conidial stage, which the author thinks may, perhaps, be that of *Entomophthora plusiae* Giard, was found in this case.

Barss (H. P.) & Stearns (H. C.). **The green muscardine fungus (Oospora destructor (Metschn.) Delacroix) on European earwig and other insects in Oregon.**—Abs. in *Phytopath.*, xv, 11, p. 729, 1925.

A fungous disease apparently identical with the green muscardine of Europe has repeatedly been observed at Portland, Oregon, on European earwigs and other insects, both outdoors and in the insectary of the State Board of Horticulture. The morphological characters of the fungus correspond with those given by Delacroix and Vast for *Oospora destructor* [*Metarrhizium anisopliae*]. It was readily cultured and gave positive results when inoculated into healthy earwigs. High humidity appears to be essential to infection.

CIFERRI (R.). **Studi sulle Torulopsidaceae. Sui nome generici di Torula, Eutorula, Torulopsis, Cryptococcus e sul nome di gruppo Torulaceae.** [Study of the Torulopsidaceae. On the generic names *Torula*, *Eutorula*, *Torulopsis*, *Cryptococcus* and on the names of the group Torulaceae.]—*Atti Ist. Bot. Univ. di Pavia*, Ser. 3, ii, pp. 129–146, 1925.

In this paper the author discusses, on the basis of observations made by himself and previous investigators, the taxonomy of the genera of the Torulaceae and points out that *Torula* has been used by different authors to cover a genus of the Dematiaceae and also one of the Mucedinaceae, the latter including the pseudosaccharomycetes or blastomycetes.

It is proposed to found the new group Torulopsidaceae for the Mucedinous forms, with the genera *Torulopsis* Berlese emend. Ciferri (= *Torula* Turpin p.p. and *Cryptococcus* p.p.) and *Eutorulopsis* n.g., the former with and the latter without oil drops. For the forms belonging to the Dematiaceae the genera *Torula* Persoon emend. Sacc. and *Eutorula* Sacc. (as subgenus) are recognized.

CIFERRI (R.) & REDAELLI (P.). **Monografia delle Torulopsidaceae a pigmento rosso.** [Monograph on the Torulopsidaceae with red pigment.]—*Atti Ist. Bot. Univ. di Pavia*, Ser. 3, ii, pp. 147–303, 8 pl., 1925.

An historical survey of the pseudosaccharomycetes (or blastomycetes) with red pigmentation, included by the first-named author under the Torulopsidaceae [see last abstract], is followed by a critical study of the subfamilies Cryptococcaeae, in which the three genera *Klockeria* Janke, *Eutorulopsis*, and *Torulopsis* are now recognized (all distinguished by an absolute absence of mycelial hyphae), and Mycotoruleae, with the genera *Sporobolomyces*, *Candida*, *Mycotorula*, and *Pseudomonilia* (all with hyphae). A third subfamily may be required to include the doubtful genus *Blastodendrion* Ota.

A detailed description of a number of species determined from a large collection of strains of red-pigmented Torulopsidaceae, mostly pathogenic to man or animals, is given. These include species of all the above genera except *Candida* and *Pseudomonilia*. In each case the morphology and cultural characters are described, and their biochemical properties are given in tabular form.

In the second part of the paper the authors discuss at length the importance of the red-pigmented Torulopsidaceae as human and animal pathogens. Various cases are cited which illustrate the active parasitism of the pseudosaccharomycetes in the living substratum. Three distinct groups are defined. The first group includes fungi of undoubted pathogenicity which have been isolated in pure culture directly from the patient and are in certain cases closely associated with a form of chronic blastomycosis with multiple foci, in others with a general cachexia without definite foci of disease. Of the red ferments belonging to this group studied by the author *Mycotorula muris* (isolated from a blastomycetic growth on a rat) is described in some detail. Notes are also given on a few other forms described in the literature.

The second group comprises fungi which ordinarily live as saprophytes but which are capable of becoming adapted to a parasitic

existence on living hosts, as has been clearly demonstrated on animals in the laboratory. They may produce generalized infections like those of the first group, or be localized in one or a few foci, causing abscesses. To this group belongs *Mycotorula pulmonalis*, isolated from a pulmonary abscess, which has been studied in detail by the author.

The third group of red-coloured Torulopsidaceae live on the animal organism but do not appear to be able to become transformed from the saprophyte to the parasite life. *Torulopsis sanniei* n. sp., isolated from the contents of tubercular cavities, and *T. bronchialis* n. sp., from the sputum of a case of bronchopneumonia, were non-pathogenic to animals in laboratory tests and belong to this group.

BAYNE-JONES (S.). **Club-formation by Actinomyces hominis in glucose broth, with a note on B. actinomycetum-comitans.**—*Journ. of Bact.*, x, 6, pp. 569–576, 1 pl., 1 fig., 1925.

Cultures of *Actinomyces hominis*, isolated from a closed lesion of a patient with actinomycosis, were grown in glucose agar and broth without the addition of serum or other animal protein. The filaments at the edges of the colonies were found to be enclosed in sheaths of hyaline material terminating in bulbous thickenings over the ends, this type of club formation closely resembling that observed in granules of the fungus in pus. It is concluded, therefore, that animal fluids are not essential as a stimulus to club formation by *A. hominis*. When isolated clubs from the original material were observed in hanging drops of glucose broth, growth was twice seen to take place from the portion of the filament attached to the proximal narrow end of the club, the bulbous part of which did not take any part in further development.

Bacillus actinomycetum-comitans was found associated with the strain of *A. hominis* under observation, this being stated to be the first record of its occurrence in actinomycosis lesions in the United States.

THAYSEN (A. C.) & BUNKER (H. J.). **Studies of the bacterial decay of textile fibres. II. A preliminary study of the deterioration of samples of artificial silk through the action of micro-organisms.**—*Biochem. Journ.*, xxix, 6, pp. 1088–1094, 1925.

In continuation of previous investigations [see this *Review*, iii, p. 517], a number of preliminary tests were carried out to determine the rate of decay of four different types of artificial silk when exposed to the action of micro-organisms. The available material consisted partly of skeins of artificial silks prepared by the viscose, Chardonnet (nitro), or cuprammonium processes, and further of two types of fabric, a lighter and a heavier, woven from cellulose acetate silk, which is known commercially as 'Celanese'.

The exposure tests fell into three groups: (1) in which the samples were placed anaerobically in a nutrient culture medium favouring the development of cellulose-decomposing bacteria, the latter being introduced into the culture flasks, which were then incubated at 37° C.; (2) in which the samples in square frames

were buried vertically to a depth of 30 cm. in a light garden soil, thus ensuring thorough exposure to the action of aerobic and anaerobic cellulose-decomposing micro-organisms of the soil; and (3) in which the samples in square frames were submerged in sea water. The results of the experiments are presented in tabular form.

In series (1) the cellulose acetate and nitro silks were probably not attacked by the bacteria used; the viscose was less resistant, while the cuprammonium sample deteriorated completely within a fortnight.

In series (2) the results were similar, except that the nitro silk was also affected. The cellulose acetate silk remained unimpaired after 30 weeks' exposure. The results of a bacteriological analysis indicated that a marked rise in the numbers of the secondary micro-flora took place first in the cuprammonium, a week later in the viscose, and three weeks afterwards in the nitro sample. A slight increase in the secondary micro-flora of the cellulose acetate silk occurred nine weeks after that observed in the cuprammonium sample. The presence of both aerobic and anaerobic cellulose-decomposing bacteria on the various samples was experimentally confirmed by inoculating pieces of the exposed silks into a medium containing filter paper. In every case, even where Celanese silk was used, the filter paper underwent decomposition.

In series (3) the results showed that the rate of decay of all samples was noticeably more rapid in the sea than in the soil. On the whole, this confirms previous observations on other types of textiles. The only marked resistance occurred in the cellulose acetate samples, and the differences in the rate of decay of the other samples were almost completely obliterated. Both aerobic and anaerobic cellulose-decomposing micro-organisms were present on all the submerged samples showing definite signs of decay.

One explanation of the high degree of resistance to decay in the cellulose acetate samples (see also *Biochem. Journ.*, xiv, p. 709, 1920) may be the presence of the cellulose in the form of a fully saturated ester. In the viscose silk the cellulose was certainly not fully esterified, while in the highly susceptible cuprammonium sample it was present in a hydrated form which had not been in any way chemically combined with acids.

Another point demanding consideration is the crystalline nature of some of the samples. The cellulose acetate silk has been definitely shown (*Ber. Deutsch. Chem. Gesellsch.*, liii, p. 2162, 1920) to be of an amorphous nature, while cellulose precipitated from cuprammonium solution and viscose silk are both crystalline, like untreated cellulose.

MILES (L. E.). **A Pyrenomycetous leaf spot of Bur Clover.**—*Phytopath.*, xv, 11, pp. 677–690, 2 pl., 2 figs., 2 graphs, 1925.

Bur clover (*Medicago maculata*) near Auburn, Alabama, is stated to be subject to attack by a leaf spot, first observed in 1920.

The first symptom of the disease is the appearance of minute, black specks on the leaf blades (especially the under surface), stipules, and petioles, less often on other parts. On the seed, sclerotioid bodies are produced. In severe cases the intervening

tissue of the leaf turns pale green or yellow, giving the foliage a peppered appearance. Occasionally the spots may reach a diameter of 1 mm. When the petioles are severely infected, even the apparently healthy leaflets turn yellow and fall.

The causal organism of the disease is a fungus with a large, granular mycelium, numerous spherical or slightly flattened, thin-walled, ostiolate perithecia, 100 to 150 μ in diameter, and pyriform to broadly ovate asci, measuring 63 to 92 by 38 to 45 μ, with walls much thickened towards the apex. These contain eight greenish-hyaline, later honey-yellow, muriform spores, measuring 28 to 39 by 10·5 to 16 μ, with four (rarely three) transverse and one (or more commonly two) longitudinal septa.

The fungus is referred to the genus *Pseudoplea* as *P. medicaginis* n. sp., English and Latin diagnoses being given. Its upper temperature limit for development in culture was 35° C. On two different occasions wedge-shaped saltants, characterized by a deeper brown coloration of the mycelium and smaller perithecial bodies, appeared at the optimum temperature (about 20°). Under ordinary conditions of growth in pure culture no spores were produced, and inoculation experiments were therefore made with fragments of mycelium and with the sclerotioid bodies found on the seed. These were quite successful. Further tests showed that all the varieties of *M. hispida*, especially *M. hispida sardoa*, were extremely susceptible, while none of the species of clover or lucerne tested showed more than an inconspicuous spotting.

Much of the early infection, occurring in January or February on young plants, probably comes from perithecia developed on the remains of the previous season's crop. The sclerotioid bodies on the seed, which were proved to be immature perithecia capable of developing normal asci and ascospores under favourable conditions, were repeatedly shown to be capable of transmitting the disease, and there seems to be little doubt that the plants from such seed would be diseased.

Leaf infection from ascospores takes place directly through the epidermis, and sometimes a layer of dark brown pseudoparenchyma is formed by the fungus on the leaf before penetration.

The morphology and systematic position of the related organisms *Sphaerulina trifolii* Rostr. [see this *Review*, iii, p. 265] and *Pseudoplea briosiana* (Poll.) v. Höhn. (*Pleosphaerulina briosiana* Pollacci) are discussed in comparison with those of the bur clover fungus, and the union of the first two species by Petrak under the name *Pseudoplea trifolii* is not accepted owing to the absence of muriform septation in *Sphaerulina trifolii*. Inoculations with the latter fungus were fully successful only on some of the true clovers and not on *Medicago*.

TEHON (L. R.) & DANIELS (EVE). **A note on the brown leaf-spot of Alfalfa.**—*Phytopath.*, xv, 11, pp. 714–719, 1 fig., 1925.

In 1922 and 1923 diseased lucerne leaves affected by a marked browning were collected in Illinois. In 1924 numerous additional cases were observed in different parts of the State.

The first symptom of the disease is a pronounced local yellow discoloration of the tissue, which is soon transformed into a dead,

brown area. Infection is usually marginal, the spots rapidly spreading until much of the leaf is involved. The older parts of the lesions become brown and wrinkled, eventually assuming a sooty appearance from the abundant production of spores and hyphae by the fungus. The chief damage is caused by destruction of the leaflets. In the fields examined in 1924 an average of 20 per cent. of the leaves were infected.

The causal organism is considered to be identical with *Macrosporium sarcinaeforme* Cav., having upright, olive-brown, strikingly nodulose conidiophores, and olive-brown, muriform spores, borne singly at the apices of the conidiophores, which continue median growth after the spore falls, and bear others in succession. There is a marked constriction at the heavy lateral septum dividing the spore into slightly unequal halves; the epispore is minutely echinulate.

M. medicaginis Cugini, which causes a very similar disease of lucerne, is stated to be quite distinct from the fungus under investigation, the chief points of difference being briefly summarized.

Species of *Macrosporium* of the type represented by *M. sarcinaeforme* have been excluded from the genus by Elliott (*Amer. Journ. Bot.*, iv, p. 439, 1917) on account of their sarcinaeform spores, while the erect, simple conidiophores also exclude them from *Stemphylium*. The minutely echinulate epispore is a character not properly attributable to either genus. A new genus has, therefore, been created by the authors, to include this and other allied species, namely, *Thyrospora* n. g., a Latin diagnosis being given and *M. sarcinaeforme* being transferred to it as *T. sarcinaeforme* (Cav.) comb. nov.

FRON [G.] & GAILLAT (Mlle). **Contribution à l'étude du genre Ligniera.** [Contribution to the study of the genus *Ligniera.*] —*Bull. Soc. Myc. de France*, xli, 3, pp. 388–390, 1 pl., 1925.

In the early spring (February–March) of 1925 the authors noticed an abnormal condition of the roots of *Poa annua*, which disappeared towards May, but is believed to be widespread, as it was found in samples originating from several widely separated localities in France. The characteristic symptom was a swelling in the shape of an elongated vesicle at the distal end of the root hairs. When stained with cotton blue, the vesicles were seen to contain agglomerated, rounded, granular masses, which later broke down into a fine powder composed of small spherical bodies, less than 1 μ in diameter, each with an indistinct filiform appendage of about the same length. The authors consider these bodies to be zoospores that penetrate through the membranes into the epidermal cells of the roots, and probably also occasionally immediately into the root hairs. Inside the epidermal cell the myxamoebae coalesce into granular, spherical masses, 4 to 6 μ in diameter, which are termed sporogonia; when the epidermal cell gives rise to a root hair, the sporogonia pass into the latter in the form of short chains, and finally reach the apical swelling. After infection and the formation of sporogonia either in the epidermal cells or in the root hairs, three to six denser masses (sporocysts), each about 2 μ in diameter, appear within the sporogonium, and the contents of these become

transformed into zoospores which are set free by passing through the cell walls.

The organism is regarded as belonging to the Plasmodiophoraceae, and is placed in the genus *Ligniera*, as *L. pilorum* n.sp., a brief Latin diagnosis being appended.

TILFORD (P. E.). **Brown patch of lawns and golf greens.**—*Ohio Agric. Exper. Stat. Bull.* 117, pp. 185–187, 1 fig., 1925.

During the summer of 1925 considerable damage was reported on Ohio golf greens and lawns as a result of the brown patches caused by the fungus *Rhizoctonia solani* [see this *Review*, iv, p. 38]. Different varieties of grass vary in their susceptibility to attack. Red fescue [*Festuca rubra*] and some of the bent-grasses [*Agrostis*] are very susceptible; red top [*Agrostis palustris*], however, is more resistant. The following appear to be immune: Kentucky blue grass [*Poa pratensis*], crab grass [*Panicum sanguinale*], Bermuda grass [*Cynodon dactylon*], and white clover [*Trifolium repens*].

The fungus occurs only on the blades, forming a network-like growth, visible especially in the early morning. Later on, especially in warm, dry weather, the grass has a withered and burnt appearance.

Watering in the early morning checks the mycelial development of the fungus to some extent. The application of fungicides as a preventive is recommended, but owing to the detrimental effect of copper on grass, mercury chlorophenolate (uspulun or semesan) is preferable to Bordeaux mixture for this purpose. Satisfactory results have been obtained with these preparations at the rate of 1 lb. to 50 galls. of water. After treatment, the patches should be top-dressed with 1 cb. yd. of well-screened compost, to which 5 to 7 lb. sulphate of ammonia has been added, for each 500 sq. yds. of lawn.

EDDY (E. D.). **A storage rot of Peaches caused by a new species of Choanephora.**—*Phytopath.*, xv, 10, pp. 607–610, 1 fig., 1925.

In the summer of 1918 a species of *Choanephora* closely related to *C. cucurbitarum* was isolated by Mix from decaying peaches on the New York market. Monospore cultures were obtained, and in the autumn of 1919 inoculation experiments were carried out on wounded peaches with positive results, a soft brown rot involving the entire fruit about a week after infection.

The fungus, which has been named *C. persicaria* n. sp. (with an English diagnosis), was found to grow well on various artificial media. The fertile hyphae, 0·5 to 2 mm. in height, arise directly from the surface of the medium and produce a single spherical, black sporangium, averaging 100 μ in diameter. The oval, elliptical, elongated or irregular, hyaline or faintly tinted spores, measuring 19 to 22 by 11 to 15 μ, bear a few extremely fine, radiating appendages, as long as or longer than themselves, in groups at either pole. A few cylindrical, hyaline chlamydospores, measuring 15 to 26·1 by 11 to 16 μ, were also observed, but neither conidia nor zygospores were formed.

WILLAMAN (J. J.), PERVIER (N. C.), & TRIEBOLD (H. O.). **Biochemistry of plant diseases. V. Relation between susceptibility to brown rot in Plums and physical and chemical properties.**—*Botan. Gaz.*, lxxx, 2, pp. 121–144, 2 figs., 1925.

This paper is an account of experiments which show that the resistance and susceptibility of plums to brown rot can be related to the chemical and mechanical characteristics of the fruit.

During the seasons of 1922 and 1923, eleven varieties of plums at six stages of ripeness were analysed. Crude fibre, pentosans, and dry matter were determined, and the toughness of skin and firmness of flesh measured. Details of the methods employed in these experiments, together with tables illustrating the results obtained, are given.

It was generally found that resistant varieties had a higher crude fibre and pentosan content than the susceptible, especially in the ripe fruit, the correlation being more marked when both were taken together than when either was considered separately.

The toughness of the skin decreases considerably towards maturity, and the fruit tissues become softer. Both these phenomena were more noticeable in the susceptible varieties, and have an undoubted influence on susceptibility at this stage. When, however, the plums become ripe or over-ripe these differences tend to disappear, leaving all varieties equally susceptible to brown rot.

PLAKIDAS (A. G.). **An obscure new disease of the Strawberry in California.**—Abs. in *Phytopath.*, xv, 11, p. 730, 1925.

A disease locally known as 'blight' is stated to be responsible for a serious decline in some strawberry-growing regions of California. The most conspicuous symptoms of the disturbance, which is widespread in the Santa Clara and Pajaro Valleys, and also occurs in other sections of the State, are the yellow discoloration of the leaves at the margins and between the large veins, accompanied by a characteristic curling and dwarfing of the leaves and consequent stunting of the entire plant [see also this *Review*, iii, p. 281; iv, p. 462]. The roots of the affected plants remain healthy, and as a rule the diseased individuals survive, but they are permanently stunted and all the stolons arising from them are diseased. Apparently the disease is not seed borne, seedlings obtained from the seed of affected plants being healthy. Infection spreads very rapidly, and is believed to be transmissible from diseased to healthy individuals by the red spider (*Tetranychus telarius*) and the strawberry aphis (*Myzus fragaefolii*). Altogether the disease has many of the characteristics of mosaic.

ZELLER (S. M.) & NORRIS (R. K.). **Spur blight (Mycosphaerella rubina) of Raspberry in Oregon.**—Abs. in *Phytopath.*, xv, 11, p. 728, 1925.

Spur blight (*Mycosphaerella rubina*) is stated to be widely distributed west of the Cascade Mountains on wild and cultivated species of *Rubus* under favourable climatic conditions. In commercial plantations of western Oregon the disease occurs on Cuthbert red raspberries, loganberries [*Rubus loganobaccus*: see this

Review, iv, p. 609], and less severely on black raspberries [*R. occidentalis*]. The damage to the first-named host amounts sometimes to 50 per cent. of the crop. Good control of spur blight and vigorous cane growth have been secured by the application of Bordeaux mixture when the canes are about 8 inches in height, and again at 15 to 30 inches.

ZELLER (S. M.). **Preliminary reports on transmission of dwarf of Loganberry.**—Abs. in *Phytopath.*, xv, 11, p. 732, 1925.

Aphids originally obtained from *Rosa rubiginosa* were allowed to feed for several days on succulent loganberry [*Rubus loganobaccus*] plants affected with dwarf disease, and were then transferred to the young leaves of healthy loganberry plants grown under cages. Slight or severe necrosis along the veins and leaf margins resulted within six days, and all subsequent growth exhibited the typical field symptoms of dwarf. Healthy loganberry plants to which aphids were transferred after feeding on sound individuals failed to contract any symptoms of the disease.

LINDFORS (T.). **Korta anvisningar rörande bekämpandet av amerikanska Krusbärsmjöldaggen.** [Brief directions for the control of American Gooseberry mildew.]—*Centralanst. för Jordbruksförsök, Flygblad* 107, 4 pp., 1925. [Received February, 1926.]

The results of five years' experiments (1916 to 1921) have led to the following recommendations for the control of American gooseberry mildew [*Sphaerotheca mors-uvae*] in Sweden. The bushes should be planted in open ground with ample circulation of air and good drainage. They should be thinned out in the autumn and all infected shoots pruned off and burnt. Immediately before the buds appear an application of formalin 1 in 40 should be given, followed (if necessary) by the repeated use of formalin 1 in 100, a 5 to 7 per cent. solution of the best soft soap [see this *Review*, ii, p. 457], a 2 per cent. solution of common salt, 1 per cent. soda, or lime-sulphur at half the strength used for orchard trees, beginning directly the first symptoms are observed or just after flowering.

COOK (M. T.). **Clorosis de la Piña.** [Pineapple chlorosis.]—*Rev. Agric. Puerto Rico*, xv, 6, pp. 296–297, 1925.

In the present note a very brief description is given of the symptoms of pineapple chlorosis. The disease is ascribed to an excess of lime in the soil, and may be cured by applications of iron sulphate at the rate of 25 lb. in 50 gallons water to every four acres of land. The number of applications depends on the quantity of lime contained in the soil; in some cases one application every four months is sufficient, while in others the treatment must be repeated every month. Young plants react best to this treatment, which is said to be useless if the plantations are more than a year old.

CAMPBELL (J. A.). **Stationary spraying plants for the orchard.**—*New Zealand Journ. of Agric.*, xxxi, 5, pp. 279–285, 1925.

Experiments were carried out in four different orchards in the Nelson Province [New Zealand] to determine the efficiency of

spraying with a stationary engine and pipe-lines through the orchard. Details of the construction and installation of the plant are given in each case. The pipes used varied from $\frac{3}{4}$ to $\frac{1}{2}$ inch in diameter. According to the reports received, very satisfactory results have been obtained, and it is anticipated that the method will become popular. In one case it was estimated that an orchard of 28 acres, containing 4,500 trees with 11,000 ft. of piping, could be sprayed with three hoses in three working days of eight hours each.

YOUNG (H. C.). **Colloidal sulphur as a spray material.**—*Ann. Missouri Bot. Gard.*, xii, 2, pp. 133–143, 1925.

In a preceding paper dealing with the toxic properties of sulphur [see this *Review*, ii, p. 460], the author stated that sulphur became toxic to fungi chiefly after oxidation into pentathionic acid. The conditions favourable to this toxic action do not, however, correspond with those existing in most of the sprays generally used. In the present paper an account is given of experiments made in five different States to test the comparative value of certain new, and of existing representative sprays from a commercial standpoint in relation to the control of apple scab [*Venturia inaequalis*] and other diseases. It was hoped that a sulphur spray could be developed that would not only control apple diseases but also those of other fruits and of vegetables.

Two types of colloidal sulphur were prepared as follows. One, the precipitated sulphur, was made with 10 galls. lime-sulphur, 10 galls. water, and 1 lb. glue (previously dissolved in hot water), to which was added sulphuric acid diluted with 3 parts water until the reaction of the mixture was P_H 4·2. After decanting the supernatant liquid, the residue, which contained 1 lb. sulphur per gallon, was used as a spray by adding 5 galls. of the precipitate to 95 galls. water. The second type, colloidal soluble sulphur, consisted of 15 galls. of a saturated solution of sodium thiosulphate (hypo) stirred into 5 galls. concentrated sulphuric acid, and neutralized with NaOH as no centrifuge was available.

The effect of these preparations was compared with that of the following: lime-sulphur (1–40) alone and with glue and casein, respectively; further, sulphur-glue, sulphur-casein (both 8–4–50 formula), sulphur-lead arsenate dust (90–10) alone and with glue and casein, sublimed sulphur (16 lb.) with casein spreader, the same with lime (16 lb.) and casein, ground sulphur as sublimed sulphur, and copper sprays. The colloidal and precipitated sprays contained 5 lb. sulphur per 100 galls., applied at the rate of 8 to 12 galls. per tree, while the sulphur dusts were used at the rate of 5 lb. per tree and the copper dusts at 4 lb.

The season was not favourable to scab development, and it has been difficult to draw any definite conclusions as to the value of one sulphur spray over another. In general, it appeared from the results [which are presented in tabular form] that the precipitated sulphur was less effective than, but not so injurious to the trees as, lime-sulphur, while it was more effective than dusts, dry mixtures, or sulphur paste. It caused no injury to apple foliage nor, in later tests, to that of peaches, whereas considerable burning (though

not enough to be commercially important) resulted from the use of the soluble colloidal mixture, undoubtedly due to the sodium salts present.

A semi-solid buttermilk as prepared by the Consolidated Products Co. of Chicago, added to both precipitated and colloidal sulphur, caused the mixtures to adhere more readily to the leaf surface.

The prospect of obtaining a general sulphur spray that can be used on all fruits seems certain, the more so that the absence of necessary equipment prevented proper purification of the author's preparations.

EBERHARDT & CHEVALIER (J.). **Sur un traitement nouveau des maladies des Pommes de terre.** [A new treatment against Potato diseases.]—*Comptes Rendus Acad. des Sciences*, clxxxi, 20, pp. 733–735, 1925.

Spraying potatoes with emulsions of sulphuretted hydrocarbons obtained from resins by treatment with phosphoric acid and sulphur [the method being very briefly described] is claimed by the authors to have successfully controlled aphids, during three years in succession, and to have apparently checked the development of the so-called degeneration diseases. These sprays are claimed to be efficient also against *Phytophthora infestans* on potatoes and *Sphaerotheca pannosa* on roses.

FARSKÝ (O.). **Zkušenosti s některými preparáty doporučovanými k ochraně rostlin.** [Experiments with some preparations recommended for the protection of plants.]—*Ochrana Rostlin*, v, 4–5, pp. 76–79; 6, pp. 82–89, 1925.

This is a somewhat detailed report of experiments made in 1924 at the Agricultural Experiment Institute at Brno [Brünn, Czecho-Slovakia] to test the efficacy of a number of proprietary fungicides and insecticides. Favourable results were obtained with the following fungicides. Arborol, prepared by Spolek pro Chemickou a Hutni Vyrobu [Society of Chemical and Foundry Industries] in Aussig a. Elbe, recommended against *Monilia*, *Fusicladium*, and *Capnodium*; also an effective insecticide. Sulikol (sulfur liquidum colloidale) prepared by Bohuminske Chemicke Zavody in Bohumin, against Erysiphaceae, *Fusicladium*, *Exoascus* [*Taphrina*], and *Monilia* spp. This preparation is also recommended for use in combination with the other liquid fungicides and insecticides, as it mixes easily and without sediment with all kinds of liquids.

Cusisa and Nosperal-Höchst gave unsatisfactory results, chiefly because of leaf injury caused by their use.

RIEHM (E.). **Anwendung staubförmiger Mittel im Pflanzenschutz.** [The use of dusts in plant protection.]—*Zeitschr. Angew. Chem.*, xxxviii, 46, pp. 1032–1034, 1925.

In continuation of his previous paper [see this *Review*, iv, p. 340] the writer discusses recent developments in the use of dusts as fungicides and insecticides in Germany. Certain of the new German preparations, e.g., abavit, trockenbeize Höchst, and tutan, which are

officially recommended by the Plant Protection Service [see this *Review*, v, p. 113], are said to appear to be superior to the American dusts in the control of bunt [*Tilletia tritici* and *T. levis*].

The need for a reliable substitute for Bordeaux mixture in the vineyard is emphasized. Sanders's copper lime dust is stated to give satisfactory results when applied to moist foliage, but not on dry leaves, owing to the conversion of the calcium hydroxide into calcium carbonate. Nosperit (Farbwerke, Höchst) appears to give promise of success in this direction.

Uspulun dust has been found effectual as a soil disinfectant in the control of club-root of cabbage [*Plasmodiophora brassicae*: see this *Review*, iv, p. 389], but this method is too expensive for general use on a large scale, and there appears to be little prospect of extending this form of treatment.

BAYON (H. P.). **Virus diseases of bacteria, plants and vertebrates.**—*Journ. Trop. Med. & Hygiene*, xxix, 2, pp. 17–37, 1926.

In this paper, which is stated to embody the results of studies commenced in 1913 and pursued (with interruptions) until 1925, the writer discusses the following aspects of virus diseases: (1) general properties of filterable viruses; (2) virus diseases of bacteria (Twort's bacteriolysin) [see next abstract]; (3) virus diseases of plants (in which a brief account is given of tobacco mosaic and potato leaf roll); (4) virus diseases of animals; (5) virus diseases transmissible from animals to man: (6) neurotrope viruses; (7) influenzal catarrh and filter-passers; (8) molluscum contagiosum and warts; (9) virus diseases conveyed by arthropods; (10) neoplasms, parasites, and viruses; (11) Rous fowl sarcoma and similar viruses; their relation to oncology; and (12) specific properties of microplasms and classification.

It is concluded that the extent, importance, and future possibilities of the study of filterable viruses or microplasms are as yet barely realized.

TWORT (F. W.). **The transmissible bacterial lysin and its action on dead bacteria.**—*The Lancet*, ccix, 5326, pp. 642–644, 1925.

In continuation of his previous investigations on the transmissible bacterial lysin [see this *Review*, iii, p. 96; iv, p. 753], the writer has conducted further experiments which are described in some detail.

A new strain of the lysable white micrococcus and fresh active lysin were obtained from vaccinia. The micrococcus was isolated free from lysin and grown for 24 hours on agar slopes, from which a fairly turbid emulsion was made with normal saline solution. The emulsion was heated at 60° C. for one hour to kill the bacteria, mixed with an equal quantity of ordinary sterile peptone-beef broth, and 2 c.c. of the mixture pipetted into each of four sterile test tubes. Tube (1) received no addition; (2) was inoculated with a loopful of pure living micrococcus; (3) with two drops of filtered

lysin; and (4) with two drops of filtered lysin and a loopful of the living micrococcus. The tubes were inoculated at 37°. After 24 hours tubes (1) and (3) showed no visible change, (2) showed an increase of turbidity, and (4) a marked clearing of the emulsion. The use of a coccus emulsion prepared from cultures a week or more old, and of an emulsion heated at 75° to 100° or autoclaved at 120° for five minutes, also gave generally similar results. The partial opacity of tube (4) is stated to be due in some measure to the survival of some of the living bacteria.

These results are thought to show clearly that there is lysis of dead bacteria when the lytic agent is being freshly produced in the presence of living bacteria of the same variety. They may further indicate that, whereas the ultra-microscopic virus will grow only on the living bacteria, the lysin secreted by it will act on both the living and the dead.

Experiments were carried out to investigate the possible presence of a complementary agent. The lysable micrococcus used in the above experiment was grown in ordinary peptone-beef broth for three days at 37°, passed through a Doulton brown filter, and the resulting filtrate mixed with an equal quantity of fresh sterile broth. This mixture was added to the emulsion of dead micrococci instead of the ordinary broth used in the first tests. Four tubes were then inoculated, with slight variations, on the lines described above. In none of the tests was there any evidence of lysis in the tube (3), from which it is clear that the living micrococcus cannot be replaced by filtrates of the coccus growth. Tube (4) showed the same lysis of the emulsion as was observed in the original experiment.

In view of the fact that various workers have reported temperatures above 65° to be necessary for the complete destruction of the transmissible lysin associated with the vaccinia micrococcus, the writer has repeated his original tests of 1915 with identical results, namely, the destruction of lysin at 60° in one hour. It is thought that the conflicting data obtained in this connexion may be due partly to certain modifications in experimental technique, and also to a difference in the thermal death-point of the lysins associated with various bacteria.

An additional point of some interest was observed during these experiments. When a diluted and almost completely destroyed lysin is pipetted down agar slopes which are then smeared with the coccus and incubated at 37°, the resulting growth is often a continuous white streak entirely free from clear areas. In the third, fourth, and sometimes even in the second subcultures, a few clear areas may appear, from which the active lysin can be reisolated. This appears to show that a growth of micrococcus, apparently free from lysin, may contain the lytic agent in a state of suspense. D'Hérelle has always advanced this explanation when the spontaneous appearance of the lysin has been used as an argument against the virus theory. These experiments are considered to indicate that this explanation may sometimes be correct.

It is concluded that no definite proof has yet been furnished that the transmissible lysin is a virus, many arguments being available both for and against this view.

Wollman (E.). **Recherches sur la bactériophagie (phénomène de Twort-d'Hérelle).** [Researches on bacteriophagy (the Twort-d'Hérelle phenomenon).]—*Ann. Inst. Pasteur*, xxxix, 10, pp. 789–832, 2 figs., 1925.

In this paper the writer gives a survey of the researches to date on bacteriophagy or transmissible lysis (the Twort-d'Hérelle phenomenon) [see preceding abstract] and summarizes his own observations on the same subject. The parasitic and enzymic interpretations of bacteriophagy are regarded as very improbable, and an attempt is made to explain the phenomenon on the basis of Darwin's pangenes. Bacteriophagy then appears as the result of a variation or mutation, the determining element of which is transmissible direct from mother to daughter cell or indirectly through the external milieu, from the diseased to the normal cell. This theory is thought to be applicable also to other obscure processes, such as mosaic, inoculable tumours, and the like.

Marshall (M. S.). **Observations on d'Hérelle's bacteriophage.**—*Journ. Infect. Dis.*, xxxvii, 2, pp. 126–160, 2 pl., 2 graphs, 1925.

The object of the work described in considerable detail in this paper was the study of the phenomena of a d'Hérelle type or strain of bacteriophage [see preceding abstracts] from a quantitative standpoint, particularly as regards the mutual relation between bacterial cells and bacteriophage. Studies of certain corollary features were also made from the same point of view, with special reference to the absorption of bacteriophage by bacterial cells, the diffusion of bacteriophage through agar and semi-permeable membranes, the resistant strains, and the lysed culture as antigen.

The normal rate of multiplication of *Eberthella* [*Bacillus*] *dysenteriae* Shiga during the logarithmic phase of growth was determined, the rate of fission being once every 31·3 minutes in beef infusion broth at 37° C. The effect of the bacteriophage on this normal logarithmic rate is such as to cause no variation from the normal for a shorter or longer period, according to the concentrations both of the bacteriophage and of the organisms; subsequently a period of rapid lysis ensues. During this exposure of the organisms to the bacteriophage, a period of stability in bacteriophage concentration occurs, followed by a period of rapid lysis which synchronizes to some extent with that of bacterial lysis.

Living bacterial cells sensitive to the lytic action of the bacteriophage absorb the latter from a broth suspension within 15 minutes at 37° C., while dead cells of the same strain effect progressive adsorption over a period of at least one hour. Tests involving the absorption of bacteriophage by heterologous bacteria indicated absorption from a broth suspension as above with some strains and none with others. It is concluded that there is no specificity of bacteriophage absorption from the standpoint of the accepted bacteriologic grouping, but that there is a specificity as regards susceptibility to lysis by the bacteriophage..

The bacteriophage was found to diffuse 1 mm. in 2 per cent. agar in 48 hours, and to diffuse through parchmentized and collodion

membranes. Adsorption appears to play a part in diffusion through parchmentized membranes.

Evidence is furnished of the probability that the resistant strains of bacteria are combinations of normal and older cells with a natural (or acquired) resistance, all associated with adsorbed and absorbed bacteriophage.

The use of typhoid cultures subjected to lysis by bacteriophage as antigen in animal inoculation experiments failed to produce a specific anti-typhoid serum when tested for the presence of agglutinins and precipitins against the normal and the lysed antigen. Normal anti-typhoid immune serum, although possessing a high agglutinin concentration specific for the Eberth strain of the typhoid bacillus, was not found to give specific precipitation with bacteriophage-lysed *E.*[*B.*] *typhi* antigen.

A discussion of the structural unity of the bacteriophage follows, and concurrence is expressed with the view that the agent responsible for transmissible bacteriolysis is a living ultramicroscopic entity.

BRONFENBRENNER (J. J.). **Effect of electrolytes on the rate of inactivation of bacteriophage during precipitation.**—*Proc. Soc. Exper. Biol. & Med.*, xxiii, 3, p. 187, 1925.

The bacteriophage principle [see preceding abstracts] is stated to be generally carried down in the sediment when lytic filtrates undergo precipitation. In certain cases the lytic agent remains active in the sediment, and can be recovered by solution of the latter, while in others it becomes inactive after adsorption.

For instance, if lytic filtrate, as ordinarily prepared, be precipitated by an excess of acetone, the active bacteriophage can be recovered from the precipitate. However, if the NaCl concentration of the filtrate be increased to 1 per cent. or over, 99 per cent. of the phage is lost shortly after the addition of the acetone. The inactivating effect of salts with divalent cations is even more pronounced, and in certain instances even 0·05 molar concentrations of salts produce rapid and complete inactivation of the lytic agent when acetone is added. Salts with monovalent and divalent cations mixed in suitable proportions antagonize one another in the production of this effect. A similar phenomenon is observed also in the case of alcohol precipitation of the bacteriophage. Thus, if a small amount of $CaCl_2$ be added to a lytic filtrate, it becomes considerably less subject to injury by the alcohol, in virtue of the fact that the effect of the NaCl contained in the filtrates is diminished by the addition of $CaCl_2$.

BRONFENBRENNER (J. J.) & KORB (C.). **Studies on the bacteriophage of d'Hérelle. I. Is the lytic principle volatile?**—*Journ. Exper. Med.*, xli, 1, pp. 73–79, 1 diag., 1925.

The writers repeated the experiments of Olsen and Yasaki (*Klin. Wochenschr.*, ii, p. 1879, 1923), in which volatility of the lytic principle [see preceding abstracts] was believed to have been demonstrated, but with entirely negative results. Full details of the methods used are given and the discrepancy between the results

is attributed to the transfer of minute droplets of the original active filtrate to the distillate in the above-named workers' experiments.

BRONFENBRENNER (J. J.) & KORB (C.). **Studies on the bacteriophage of d'Hérelle. II. Effect of alcohol on the bacteriophage of d'Hérelle.**—*Journ. Exper. Med.*, xlii, 3, pp. 419–429, 2 graphs, 1925.

The results of experiments [the technique of which is described] showed that when strains of bacteriophage are precipitated by alcohol at room temperature, their activity rapidly and progressively decreases until they are totally destroyed between 6 and 24 hours after exposure. The strains used in these tests were active against *Bacillus dysenteriae* Shiga and Flexner, respectively, *B. enteridis* M.T. I, and *B. pestis caviae* M.T. II. At 7° C. the destruction of lytic activity is considerably slower, measurable traces being detected even after four weeks' exposure to alcohol. This does not appear to be due to the existence in the original filtrate of a fraction relatively resistant to the effect of alcohol. The inactivation of bacteriophage by alcohol seems, therefore, to be analogous to the alcoholic inactivation of certain enzymes and toxins.

In all cases the residual lytic activity was found to be transmissible in series.

BRONFENBRENNER (J. J.) & KORB (C.). **Studies on the bacteriophage of d'Hérelle. III. Some of the factors determining the number and size of plaques of bacterial lysis on agar.**—*Journ. Exper. Med.*, xlii, 4, pp. 483–497, 1 pl., 1925.

The experiments reported in this paper are regarded as confirming the fact that the lytic principle [see preceding abstracts] is distributed in active solution in a state of indivisible units. This permits its quantitative evaluation by serial dilution as well as by plating on agar. The low readings frequently given by the latter method were shown, by varying the concentration of the medium, to be due to adsorption of the lytic agent on agar. When the concentration of the latter is increased from 0·3 to 2·5 per cent. the number of plaques of lysis is reduced over 100 times, while at the same time the average size of the plaques also decreases to approximately one-tenth of the original.

When the culture exposed to the action of the lytic agent is composed of young susceptible bacteria, the greater the concentration of the latter, the smaller the plaques. In cultures composed partly of young and partly of old susceptible bacteria, both the size and number of the plaques are diminished with the increase in the relative concentration of old bacteria. On the other hand, the presence in the culture of resistant bacteria affects neither the size nor the number of the plaques. Those appearing in the presence of a high concentration of resistant variants in the culture are relatively indistinct owing to overgrowth.

Under controlled conditions the size of the plaques is found to be determined by the character of the lytic filtrate, so that in the case of lytic agents acting upon more than one bacterial species the size of the plaques remains constant, irrespective of the bacterial substratum used for the production of the active filtrate.

BRONFENBRENNER (J. J.) & KORB (C.). **Studies on the bacteriophage of d'Hérelle. IV. Concerning the oneness of the bacteriophage.**—*Journ. Exper. Med.*, xlii, 6, pp. 821–828, 3 graphs, 1925.

Lytic filtrates [see preceding abstracts], active against *Bacillus dysenteriae* Shiga, *B. coli*, *B. pestis caviae*, and staphylococcus, respectively, proved to be differently affected by changes in hydrogen-ion concentration. Anti-staphylococcus lysis was the least resistant, showing deterioration in three hours at 7° C. beyond the zone of hydrogen-ion concentration limited by $C_H = 6{\cdot}3 \times 10^{-5}$ and $C_H = 1{\cdot}6 \times 10^{-9}$. Anti-*pestis caviae* was the most resistant, retaining full activity in the zone from $C_H = 1 \times 10^{-3}$ to $C_H = 3{\cdot}5 \times 10^{-12}$. The persistence of these differences in individual resistance, notwithstanding the repeated passage of lytic filtrates through bacterial cultures other than those against which they were primarily active, is regarded as an argument in favour of a multiplicity of bacteriophages.

BRONFENBRENNER (J. J.) & KORB (C.). **Studies on the bacteriophage of d'Hérelle. V. Effect of the electrolytes on the rate of inactivation of bacteriophage by alcohol.**—*Journ. Exper. Med.*, xliii, 1, pp. 71–86, 1 graph, 1926.

It has previously been shown (*Proc. Soc. Exper. Biol. & Med.*, xxi, p. 177, 1923–24) that the activity of d'Hérelle's bacteriophage [see preceding abstracts] is rapidly reduced by the addition of an excess of alcohol. This period of rapid inactivation seems roughly to coincide with the process of precipitation occurring when alcohol is added to the lytic filtrate. Further exposure to alcohol affects the residual lytic activity comparatively slowly.

It is shown in the present paper that the addition of neutral salts to the lytic filtrate results in an increased rate of inactivation of the latter when alcohol is added to it. This effect is the more marked the higher the valency of the cation. Conversely, removal by dialysis of salts originally present in the lytic filtrate tends to render the lytic agent less sensitive to alcohol. Restitution of the original salt content to the dialyzed filtrate tends to bring the sensitiveness to alcohol in the latter to the level of the non-dialyzed control.

It appears, therefore, that inactivation of the lytic agent by alcohol depends directly on the rate of precipitation of the coagulable constituents of the medium, and does not result from a direct toxic action of alcohol on *Bacteriophagum intestinale*. Considered in conjunction with the writers' earlier data, these results are regarded as favouring the theory that transmissible lysis is due to a chemical agent.

ALESSANDRINI (A.). **Influenza dei cambiamenti di reazione del mezzo sulla attività del batteriofago.** [Influence of changes in the reaction of the medium on the activity of the bacteriophage.]—*Ann. d'Igiene*, xxxv, 12, pp. 1025–1032, 1925.

The author's experiments [details of which are given] with two strains of bacteriophage (anti-typhus and anti-Shiga) [see preceding abstracts] indicate that their partial or total failure to develop on

gelatine or other organic colloids, e.g., blood serum, ascitic liquid, gum tragacanth, and the like, is due to certain spontaneous modifications arising in these media at a thermostat temperature of 37° C.

The dynamic state of the colloidal complexes, the foremost quality of which is the instability of the particles of their constituents, is such that a slight cause (temperature) suffices to evoke an unsuspected acidity calculated to impede the phenomenon of the transmission of lysis in series. This 'potential acidity' (*Ann. d'Igiene*, xxxi, p. 743, 1921) is lowest in broth and agar; higher in blood serum and ascitic liquid; very high in gelatine; and still more so in gum tragacanth.

SHWARTZMAN (G.). **Studies on the regeneration of bacteriophage. I. The influence of partial anaerobiosis upon regeneration of a highly diluted lytic principle.**—*Journ. Exper. Med.*, xlii, 4, pp. 507–516, 3 graphs, 1925.

Quantitative studies on the potency of bacteriophage [see preceding abstracts] have established that 1/100,000,000 c.c. per c.c. of broth (a dilution of 10^{-8} of this principle) is usually the minimum capable of producing appreciable lysis. The dilutions were made in a series of tubes containing 4·5 c.c. of broth. Gratia and De Kruif have shown (*Comptes Rendus Soc. Biol.*, lxxxviii, p. 308, 1923) that if larger volumes of broth are used, a dilution of bacteriophage greater than 10^{-8} is able to produce almost complete lysis.

The writer investigated the influence of partial anaerobiosis on the regeneration of an extremely diluted bacteriophage in relation to different factors, with the following results.

The $\frac{\text{surface area}}{\text{total volume}}$ ratio $= 0{\cdot}5$ expresses the degree of anaerobiosis necessary for regeneration of an extreme dilution of the bacteriophage. An increase in the ratio interferes with regeneration.

The regeneration of the highly diluted bacteriophage under partial anaerobiosis begins definitely at the third hour of bacterial growth and is completed after the sixth hour.

To obtain the full regeneration of an extreme dilution of bacteriophage it is sufficient to restrict for one hour, within the first three hours of bacterial growth, the supply of air to a culture containing it.

KUNKEL (L. O.). **Mosaic and related diseases.**—*Amer. Journ. of Botany*, xii, 8, pp. 517–521, 1925.

A brief review is given of some of the principal investigations on virus diseases, with a discussion of the hypotheses which have been advanced to explain them. Some of the most promising lines of work for future researches are also indicated.

MELIN (E.). **Untersuchungen über die Bedeutung der Baummykorrhiza. Eine ökologisch-physiologische Studie.** [Investigations on the significance of tree mycorrhiza. An ecological and physiological study.]—152 pp., 32 figs., 16 graphs, Jena, G. Fischer, 1925.

In this extensive monograph the author summarizes the results of his previous investigations on the mycorrhiza problem [most of

which have been noticed in this *Review*] and describes further experiments with seedlings of *Pinus sylvestris*, *P. montana*, *Picea abies*, and *Larix europaea*. The fungus symbionts used included *Boletus luteus*, *B. variegatus*, *B. elegans*, *Mycelium radicis sylvestris* α, β, and γ, *M. r. abietis*, *M. r. atrovirens* α and β, *Rhizoctonia sylvestris*, *Amanita muscaria*, *Lactarius deliciosus*, and *Russula rubra*. The seedlings and their fungus symbionts were grown in pure culture together and separately.

The results of the experiments [which are fully discussed in the text and presented in tabular form] indicate that the mycorrhiza do not assimilate atmospheric nitrogen. The mycorrhizal fungi are able to supply the roots both with ammonium salts and with other inorganic compounds. Complex organic nitrogen compounds, e.g., nucleinic acid and peptone, are more readily assimilated by the plants with the aid of mycorrhiza than by the roots alone. Mycorrhiza should be considered as assimilatory organs (primarily of nitrogen) for the higher symbiont.

In the case of three-year-old plants the mycorrhiza attained their fullest development with NH_4Cl, nucleinic acid, and peptone as sources of nitrogen. In plant cultures with mycorrhizal fungi the hydrogen-ion concentration tends towards neutrality, exactly as in cultures with seedlings alone. Where the plants are poorly developed, a condition of equilibrium between them and the fungus symbionts can only be established with difficulty; in such cases the latter may readily assume a parasitic tendency and injure their hosts.

RAWLINS (T. E.) & SMITH (E. H.). **A mycorrhizal fungus found in the smaller roots of Celery.**—Abs. in *Phytopath.*, xv, 11, p. 727, 1925.

Heavy infection by a mycorrhizal fungus was observed in the smaller roots of celery plants grown in the delta peat soil of California. The organism is a Phycomycete, resembling the mycorrhizal fungus occurring in the roots of legumes and other plants [see this *Review*, iv, p. 301] in its almost complete restriction to the inner cortical cells. It differs from the pea endophyte, however, in the development of the intracellular absorbing mycelium, which is composed of small, distinct hyphae in place of swollen, amorphous haustoria.

ZOJA (ALFONSA). **L'immunità nelle piante.** [The immunity of plants.]—*Atti Ist. Bot. Univ. di Pavia*, Ser. 3, ii, pp. 15–47, 2 pl., 1925.

This paper deals exclusively with acquired immunity as distinct from any natural resistance to disease existing in plants. From a survey of the work of other investigators, references to which are cited, the development of an acquired immunity is regarded as being beyond doubt, but the available data are somewhat contradictory and the actual nature of the reaction which occurs in the plant demands still further investigation.

The author's experiments at Pavia with wheat germinated in an aqueous extract of cultures of *Helminthosporium sativum* have already been noticed from Carbone's review [see this *Review*, iv,

p. 752]. They are described in considerable detail in the present paper. Similar results to those previously noted were obtained with the juice of wheat plants suffering from the attack of *H. sativum*. Various explanations are offered regarding the reaction to which the immunity that had evidently been acquired by the seedlings tested may be attributed. An experiment with *H. sativum* spores germinated in close proximity to the stem of an immunized plant clearly demonstrated the fact that such plants do not lose their chemotropic attraction for the fungus.

DICKSON (J. G.). **The relation of plant physiology and chemistry to the study of disease resistance in plants.**—*Journ. Amer. Soc. Agron.*, xvii, 11, pp. 676–695, 2 figs., 4 graphs, 1925.

The results of studies carried on at Madison, Wisconsin, in connexion with the nature of predisposition to seedling blight (*Gibberella saubinetii*) in wheat and maize seedlings [see this *Review*, iii, p. 390] are described in some detail.

Wide differences were found in the chemical composition of the wheat and maize seedlings grown under varying temperature conditions, the difference in tissue composition being closely associated with, if not due to, changes in the balance of metabolism occurring in the seedlings. A difference was also found in the reaction of wheat and maize seedlings to temperature, this factor influencing the relative rate of release of reserves from the endosperm which, in turn, determines the type of metabolism within the seedling. Predisposition to disease in the seedling blight of wheat and maize is, therefore, closely associated with the growth metabolism of the hosts. The causal organism is capable of parasitic development when the metabolism of the host plants is sufficiently unbalanced to prevent the accumulation of hexose-building materials and the production of cellulose cell walls in the protective tissues. Strains of maize have been selected under low temperature conditions from selfed lines which are highly resistant to the cortical rot under field conditions and also, over a greater temperature range, in the controlled chambers [see this *Review*, ii, p. 537]. The type of metabolism occurring in the susceptible strains of maize at 28° C. exists in the resistant strains when grown at 16°, below which point the metabolism of the resistant strains is unbalanced and predisposition to disease occurs.

PORTER (C. L.). **Phenomena exhibited by fungi when grown in close proximity.**—*Proc. Indiana Acad. Sci.*, xxxiv (*1924*), pp. 259–260, 1925.

After a brief discussion of the effects on growth characters of contamination in fungus cultures [see this *Review*, iii, p. 471], the writer describes what is stated to be a hitherto unreported morphological change occurring in cultures of a number of species, including ?*Fusarium* from maize stalks, *F. cubense*, *F. conglutinans*, *F. lini*, *Sclerotium rolfsii*, and a *Penicillium* isolated from *Gladiolus* corms.

A fungus developed in these cultures which had a peculiar dissolving effect on the hyphae. These first became filled with bubble-like structures and then collapsed without leading to the

disappearance of the bubbles. In Petri dish cultures a clear zone, distinctly visible to the naked eye, gradually formed in advance of the dissolving fungus. The strongest reaction was observed with *F. cubense*, but the effect was sufficiently noticeable with *F. conglutinans* to justify attempts to arrest its development in the soil by means of the fungus.

MUHLEMAN (G. W.). **The pectinase of Sclerotinia cinerea.**—*Bot. Gaz.*, lxxx, 3, pp. 325–330, 1925.

Prune juice cultures from a plum mummy were used to obtain the pectinase of *Sclerotinia cinerea*, the mycelial felts being ground with silica. No evidence of pectinase was detected in the medium after removing the felts. On grinding, an active pectinase was, however, obtained, especially with felts of three to five days old. When apple, peach, potato, and plum disks were immersed in a solution of this pectinase (to which toluene was added as a preservative) they were macerated in from 1·5 to 4 hours, the apple and plum disks being reduced to a sauce and the potatoes to a fine pulp.

EULER (H. v.). **Ueber das Wachstum von Mikroorganismen auf bestrahlten lipoidhaltigen Nährböden. I.** [The growth of micro-organisms on irradiated lipoid-containing nutrient media. I.]—*Biochem. Zeitschr.*, clxv, 1–3, pp. 23–28, 1925.

In connexion with a series of investigations on the production, in certain substances, of the anti-rachitic properties associated with vitamin A 1 by means of ultra-violet rays, the writer conducted the following test with *Penicillium glaucum* and *Rhizopus chinensis*.

The former was grown on a medium consisting of 5 gm. NaCl, 10 gm. Na_2HPO_4, 10 gm. Na-tartrate, 0·05 gm. $CaCl_2$. 0·001 gm. $FeCl_2$, 10 gm. urea, and 20 gm. agar per litre of water, to which was added, after boiling, 10 c.c. of groundnut (*Arachis*) oil per flask of 100 c.c. In four of the fourteen flasks the oil was exposed to the rays of a mercury-quartz lamp with a current of 2·5 amperes for ten minutes. The contents of the flasks were then transferred to Petri dishes and those of the ten not yet irradiated exposed to ultra-violet rays at a distance of 8 cm. for periods of 2 to 120 minutes. The most marked increase in growth was obtained by two minutes' exposure (300 sq. mm. in 18 to 20 days compared with 150 sq. mm. in the control). Two hours' exposure resulted in a noticeable decrease (70 sq. mm. in the same period). In the remaining cultures, which received no further irradiation after the preparation of the emulsion, the results of the test were much less consistent.

In the experiments with *R. chinensis* the above medium was supplemented by the addition of 1 per cent. glucose and 2 per cent. lecithin, otherwise the technique was similar. The cultures were exposed to the rays for periods of 10 to 90 minutes. The most marked increase in growth was obtained by 20 minutes' exposure (2·5 to 3·0 sq. cm. in 28 days compared with 1·2 sq. cm. in the control). Here also prolonged exposure ($1\frac{1}{2}$ hrs.) caused a decrease (0·3 sq. cm.).

EICHINGER (A.). **Kartoffelbau und Staudenauslese, Kartoffelkontrolle.** [Potato cultivation and field selection, Potato control.]—*Deutsche Landw. Presse*, lii, 41, pp. 483–484; 42, pp. 497–498, 7 graphs, 1925.

The writer's extensive investigations have convinced him that field selection is of no value in the control of the so-called degeneration [virus] diseases of the potato. There appears to be no transmission of such qualities as high yielding power and rapidity of germination from the mother plant to the progeny. Wide variations in yield and other characters are stated to be due to incalculable modifications arising in the offspring. The regular purchase of seed potatoes of unexceptional origin appears to be the only reliable method of combating degeneration.

ROACH (W. A.) & BRIERLEY (W. B.). **Sulphur treatment of soil for wart disease.**—*Nature*, cxvi, 2928, p. 865, 1925.

During the past season experiments were carried out to supplement previous investigations on the sulphur treatment of the soil for wart disease of potatoes [*Synchytrium endobioticum*: see this *Review*, iv, p. 696]. At Ormskirk [Lancashire] sulphur was applied at the rate of 5, 7½, 10, or 15 cwt. per acre in the spring or autumn. In the untreated control plots the plants grew well but were heavily warted. In the treated plots two sets of tubers, planted in May and July, respectively, almost entirely failed to develop. The surviving plants in all the plots showed a considerable amount of infection. At Hatfield [Herts.], where 2 tons of sulphur per acre were applied, similar results were obtained.

It is evident that, in the absence of further explanation as to the soil and other factors involved, the sulphur treatment cannot be regarded as a reliable method of control.

DANA (B. F.). **The Rhizoctonia disease of Potatoes.**—*Washington Agric. Exper. Stat. Bull.* 191 (*Tech. Paper*), 78 pp., 12 figs., 1 map, 1925. [Received January, 1926.]

Rhizoctonia solani, which is stated to be extremely widespread in the State both as a parasite on numerous wild and cultivated hosts [lists of which are given] and as a saprophyte in the soil, ranks second in importance to the virus diseases as a cause of losses of potatoes in the State of Washington.

Plants may be attacked at all stages, direct injury being confined to the root system. The most important damage is probably that caused by the death of feeding roots. Stem cankers disturb the nutrition of the plant and induce abnormal position and irregular shape of the tubers, the yield of which is also directly and indirectly affected by the disease. Symptoms of rosette, giant hill [see also this *Review*, v, p. 179], and other malformations may be associated with severe attacks of *Rhizoctonia*, though there is no evidence of any causal relationship between the fungus in question and the virus diseases. Many crops following potatoes, e.g., beans, peas, spinach, strawberries, and tomatoes, are liable to serious damage as a result of soil infestation.

Tuber selection has been found valuable in the control of *Rhizoctonia* on soils reasonably free from virulent strains of the fungus. The results of ten years' investigations indicate that this method is of approximately equal efficacy with seed tuber treatment as a control measure, both being practically useless on infested soils. Owing to the reduction of the yield by seed treatment, it is recommended that the tubers should be sorted and treatment carried out only on the infected portion of the stock. The best results were given by immersion in corrosive sublimate for one or two hours at a strength of 4 or 6 oz. per 30 galls. of water [see also this *Review*, iii, p. 294]. Formaldehyde and copper carbonate dust proved inferior to corrosive sublimate in the control of the disease. The treatment should be applied in early spring to avoid injury to the sprouting tubers. It has been shown that inoculum carried into the soil on the seed tubers is more virulent than the fungus already in the soil, a fact which enhances the necessity of seed tuber selection and treatment in any serious attempt to control the disease.

Studies of cultural practices have shown that the dates of planting and harvesting influence the amount of disease in the crop. Lower temperatures and favourable moisture conditions at the beginning and end of the growing season account for an increase of infection in early plantings and on tubers left in the soil until the autumn. In general, the best time for planting appears to be about the date when maize is sown.

LINDFORS (T.). **Åtgärder för bekämpande av bladmögel och brunröta hos Potatis.** [Measures for the control of Potato blight and brown rot.]—*Centralanst. för Jordbruksförsök, Flygblad* 109, 6 pp., 2 figs., 1925.

This is a somewhat fuller account of the principal measures recommended for the control of potato blight [*Phytophthora infestans*] in Sweden than that already published [see this *Review*, iv, p. 694]. For small holdings and the like, the Ideal spraying apparatus (costing Kr. 22 to 55) has been found to give satisfactory results. With the Bill apparatus (Kr. 135) an area of 1 hect. can be sprayed in 12 to 15 hours. The Pomonax and Calimax sprayers (Kr. 75 to 80) are also recommended. A 2 per cent. Bordeaux mixture should be applied at the rate of 700 to 1000 l. per hect., the first spray being given just before flowering and the second either immediately afterwards or two to three weeks later, according to the progress of the disease.

HUTCHINSON (C. M.). **Report of the Imperial Agricultural Bacteriologist.**—*Sci. Repts. Agric. Res. Inst., Pusa, 1924–25*, pp. 36–44, 1925.

In section V of this report (p. 41) it is stated that the inoculation of betel vine [*Piper betle*] plants at Pusa with the bacterium isolated from diseased material in Bengal [see this *Review*, iv, p. 332; v, p. 148] failed to give conclusive results, apparently owing to the healthy condition of the plants. Later in the year, however, one or two individuals showed symptoms of the disease, and the same bacterium was recovered from the stems.

VENKATRAMAN (T. S.). **Report of the Government Sugar-cane Expert.**—*Sci. Repts. Agric. Res. Inst., Pusa, 1924–25,* pp. 142–151, 1 pl., 1925.

It is stated on p. 146 of this report that there are certain indications to justify the opinion that mosaic of sugar-cane may have been present in India for some time without being recognized. Symptoms very similar to those of mosaic were observed during the writer's last winter tour of Samalkota and Palur (Madras Presidency) on the Red Mauritius variety. This was the first occasion on which the suspicion of mosaic was aroused, and it has since been confirmed by both the Java and Hawaii authorities.

CIFERRI (R.). **Terza contribuzione allo studio degli Ustilaginales (N. 48–54). Alcuni micromiceti della flora Spagnola e Svizzera.** [Third contribution to the study of the Ustilaginaceae (Nos. 48–54). Some micromycetes of the Spanish and Swiss flora.]—*Atti Ist. Bot. Univ. di Pavia,* Ser. 3, ii, pp. 7–14, 1925.

The third of this series of papers [see this *Review*, iv, p. 69] comprises critical notes on several Spanish species of *Entyloma* received from González Fragoso and not included in his recent list [see this *Review*, iii, p. 610]. Three new species (with Latin diagnoses) are described. Some Swiss smuts received from E. Mayor are also included, especially a large series of forms of *Entyloma* occurring on *Hieracium*.

STEVENS (F. L.). **Hawaiian fungi.**—*Bernice P. Bishop Mus. Bull.* 19, 189 pp., 10 pl., 35 figs., 1925.

In the preface to this extensive monograph the author states that he has endeavoured to unite in one list the fungi known to exist in the Hawaiian Islands. Most of the collections, which include 393 species of 163 genera (many of which are new), were made in 1921. A classified list of hosts and fungi is given and a bibliography of 212 titles is appended.

TEHON (R.) & DANIELS (EVE). **Notes on the parasitic fungi of Illinois. II.**—*Mycologia*, xvii, 6, pp. 240–249, 1 pl., 1925.

The present paper is the second of a series of notes on the parasitic fungi recorded in Illinois [see *Mycologia*, xvi, 4, pp. 135–142, 1924] and includes the following new species of phytopathological interest.

Phacidium negundinis forms extensive cankers on small twigs of *Acer negundo*; *Phyllosticta allii* forms large, white spots, thickly dotted with black pycnidia, on onion leaves; *Phomopsis callistephi* causes ashen-grey cankers on the stems of China asters (*Callistephus hortensis*); *Chaetomella tritici* forms densely setose, black, superficial pycnidia, connected with a brown, ramified mycelium, on the inner surfaces of wheat glumes collected from prematurely dying heads. *Coniothyrium negundinis* causes the formation of cankers at the base of small twigs of *Acer negundo*; *Cryptostictis paeoniae* and *C. violae* are found on brownish spots on leaves of *Paeonia officinalis* and species of *Viola*, respectively. *Leptothyrium maximum* produces relatively small cankers, one internode in extent,

on twigs of *A. negundo*; *Cercospora menthicola* gives rise to numerous white spots (0·5 to 1·5 mm. in diameter) with a wide, dark red margin (the entire spot occasionally breaking away) on leaves of *Mentha canadensis*; *C. paeoniae* first forms tan coloured to brown spots (2 to 10 mm. in diameter) on the leaves of *Paeonia officinalis*, and later numerous concentric rings caused by the collapse of the internal tissue; *C. rhapontici* forms greyish spots, with a clearly defined brown margin, on rhubarb leaves; and *C. zea-maydis* brown or tan coloured spots, clearly outlined or convergent, on maize leaves.

SYDOW (H.). **Rusts of British Guiana and Trinidad.**—*Mycologia* xvii, 6, pp. 255–262, 1 fig., 1925.

The rusts enumerated in this paper were collected by F. L. Stevens (University of Illinois) in British Guiana and Trinidad in the summer of 1922 and determined by the author. Thirty-six species are mentioned, three of which are new.

HOTSON (J. W.). **Preliminary list of the Uredinales of Washington.**—*Univ. of Washington Biol. Stat., Puget Sound, Publ.* iv, pp. 273–391, 1925.

A list is given of 224 species of rusts from the State of Washington. In each case the synonymy, hosts, locality, and bibliographical references are given, and there are also critical notes on many of the species.

ARTHUR (J. C.). **The grass rusts of South America; based on the Holway collections.**—*Proc. Amer. Phil. Soc.*, lxiv, 2, pp. 131–223, 10 figs., 1925.

A full account is given of the two separate botanical explorations undertaken by the late E. W. D. Holway and Mrs. Holway, with the primary object of collecting grass rusts in western and eastern South America. In the survey presented in this paper the author has also taken into account, as far as possible, all other collections of this sort recorded from South America and also some additional ones found in the Arthur Herbarium, Lafayette, Indiana, and not previously published. Critical notes are given on the 74 species mentioned, with English diagnoses and a key to their determination; and there is a bibliography of 63 works containing references to the grass rusts of South America.

WEIR (J. R.). **The genus Coleosporium in the north-western United States.**—*Mycologia*, xvii, 6, pp. 225–239, 3 pl., 1 fig., 1925.

All species of *Coleosporium* are stated to form their aecidial stage on pine needles and these are very similar in appearance. Six distinct species found in the north-west of the United States are described in detail, namely, *C. adenocaulonis*, *C. madiae*, *C. occidentalis*, *C. sonchi-arvensis*, *C. ribicola*, and *C. solidaginis*.

The aecidial stage of the last-named (*Peridermium montanum*) has been reported as occurring on *Pinus contorta* in the north-western States and the uredo-teleuto stage on species of both *Aster* and *Solidago*. Inoculations made by Hedgcock and Hunt [see this

Review, ii, p. 349] indicate that in the eastern States *C. solidaginis* is a rust attacking species of *Solidago* but not those of *Aster*, and its aecidial stage (*Peridermium acicolum*) is considered to be distinct from *P. montanum*. The author's inoculations establish, however, that the western form develops its uredo-teleuto stage on both *Aster* and *Solidago*, and repeated cross-inoculations with uredospores from these two hosts proved successful. Whether the same is the case with the eastern form is regarded as still doubtful. Nevertheless, in view of the differences in the minute characters, especially of the aecidial stages, the eastern and western fungi are regarded as distinct species.

BERNARD (C.). **De grijze Dadapschimmel. (Septobasidium bogoriense.)** [The grey Dadap fungus. (*Septobasidium bogoriense*.)]—*De Thee*, vi, 3, pp. 82–85, 1 pl., 1925.

Crotalaria anagyroides, which is extensively used as a green manure for tea and rubber in the Dutch East Indies, has been added to the list of hosts of *Septobasidium bogoriense* [see this *Review*, ii, p. 145], but the writer does not anticipate any serious damage from its attacks provided a rational system of pruning is adopted. The plants should be pruned at the age of four or five months, allowed to resume growth, and cut down as soon as flowering begins. Thus full advantage can be taken of the thick foliage of the plants and the increase of organic substances which they produce in the soil, without incurring the risk of infection by *S. bogoriense*, *Corticium* [*salmonicolor*], or other fungi attacking the thick, woody stems that result from continuous pruning.

Considerable damage may be caused by the combined attacks of *S. bogoriense* and *Cephaleuros* [*parasiticus*] in tea plantations where the bushes have been weakened by unfavourable cultural or climatic conditions. On tea it is advisable to apply a soda solution to diseased branches after pruning, but in the case of *Crotalaria* direct control measures are considered unnecessary.

VAN OVEREEM (C.). **Schimmelziekten van Crotalaria usaramoensis Baker.** [Fungous diseases of *Crotalaria usaramoensis* Baker.]—*De Thee*, vi, 3, pp. 72–77, 2 pl. (1 col.), 1925.

Crotalaria usaramoensis, which was introduced into Java from tropical Africa in 1916, is stated to have proved an excellent green manure for tea, but of late years this very valuable plant has been attacked by various fungous diseases.

Sclerotium rolfsii causes a dark brown rot of the stem bases, which become covered with the coarse, white mycelium of the fungus, bearing small, white, later light brown, sclerotia. Infection is transmitted by the sclerotia falling from the plants or by the mycelium in the soil. Once the organism has gained a foothold in the plantation, it is impossible to save the crop. Since *C. usaramoensis* is extremely susceptible to infection by *S. rolfsii*, it should not be used as a cover crop for tobacco or other Solanaceae which are also liable to attack.

Sporadic attacks of a wilt disease, due to a species of *Fusarium* [see this *Review*, iv, p. 595] which has been identified by Wollen-

weber as *F. incarnatum* (Rob.) Sacc., have been reported from the Tjerebon district, where they caused very great damage. The stem bases showed an internal and external brown discoloration, the woody portion being filled with the mycelium of the fungus, which obstructed the water supply and resulted in the rapid wilting of the upper part of the plants. The pink mass at the base of the stem was found to consist of short, simple (rarely branched), sparsely septate conidiophores, slightly constricted at the apex, which abstricted four-celled, elongate-ellipsoid, hyaline conidia. The typical falcate conidia with elongated bases developed in pure culture.

Another case of severe attack by a *Fusarium*, a white species with typical falcate conidia, was reported from Sumatra. This species has not yet been determined and is not definitely known to be the primary cause of the disease.

Serious and increasing damage has been caused by *Parodiella spegazzinii* Theiss. & Syd., first observed in Sumatra in 1921 and in Java in 1923, which produces a dry, hard, black crust on the upper side of the leaves. The minute black pustules first appear along the veins of young, barely unfurled leaves, and gradually increase in numbers until the whole leaf is covered with a compact crust. At this stage the leaves curl up and rapid wilting ensues. At a distance the whole stand looks greyish-green and thin. A brief description of the morphology of the fungus is given.

Cohen Stuart (C. P.). **Wat red rust van een struik over laat.** [What is left of a bush after red rust.]—*De Thee*, vi, 3, pp. 95–96, 1 pl., 1925.

The damage caused in tea plantations by red rust (*Cephaleuros*) [*parasiticus*: see this *Review*, iii, p. 4] appears to be very much more considerable in the Dutch East Indies than in British India. In West Java the attacks of *Helopeltis* and unfavourable physiological conditions are of secondary importance. The ravages of the disease are well illustrated by photographs from the Ardjoena district. Drastic pruning, attention to soil conditions, and the use of Leguminosae as green manures are recommended as general precautionary measures against disease.

Shepherd (E. F. S.). **Notes sur les maladies du Tabac.** [Notes on the diseases of Tobacco.]—*Rev. Agric. de l'Île Maurice*, 23, pp. 585–587, 1925.

This is the first of a series of articles on the tobacco diseases of Mauritius. Mosaic has been observed in a severe form only on the new shoots that grow after the plants are cut down close to the ground. In the crop before cutting the symptoms are slight and the disease does not do much damage.

At least two distinct leaf spots occur in the island, a brown and a white. The former closely resembles in its outward symptoms that caused by *Cercospora nicotianae* (except that the spots are somewhat larger), but this fungus has never been found in association with it. Recent investigations have revealed the presence in the diseased tissues of a bacterium and of at least two species, so far unidentified, of fungi, the former being believed to be the cause of

the disease. For the control of this disease it is recommended that all affected leaves be promptly removed and burnt, and that only healthy seed be used for sowing as there is a possibility that the disease is seed-borne. The white spots are smaller in diameter than the brown, and no organism has been found in association with them; they are, therefore, believed to be of physiological origin.

COOK (M. T.). **Enfermedades de las hojas de Tabaco.** [Leaf diseases of Tobacco.]—*Rev. Agric. Puerto Rico*, xv, 6, p. 282, 1925.

Judging from the number of inquiries received by the Porto Rico Experimental Stations, tobacco leaf spot caused by *Cercospora nicotianae* appears to be widespread in the island. The damage caused by the fungus is not usually considerable, but in some localities it seems to be showing a tendency to increase. Spread is said to be favoured by excessive moisture, and also by sowing the plants too densely, as this prevents free circulation of the air among the leaves.

Annuaire international de législation agricole XIVème année—1924. [International year-book of agricultural legislation 14th year—1924.]—xlv + 1199 pp., Rome, Inst. Intern. d'Agric., 1925.

Part VII of this volume (pp. 635–714) recapitulates, from official sources, the orders relating to the protection of crops from plant diseases and insect pests issued during 1924 in various countries. The year-book further contains much valuable information on a number of subjects of general agricultural interest, such as plant production, commerce in agricultural products, legislation in connexion with agrarian organization, and the like.

GARBOWSKI (L.). **Sprawa chorób i ochrony roślin na XII Międzynarodowym Kongresie Rolniczym.** [The question of plant diseases and plant protection at the XIIth International Agricultural Congress.]—*Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], Warsaw, i, 3, pp. 27–33, 1925. [French summary.]

At the XIIth International Congress of Agriculture, held in Warsaw in June 1925, the following resolutions were passed relating to the protection of plants against diseases.

(1) On the proposal of E. Foëx and J. Saulnier, of Paris. The Congress recognizes the necessity of an international agreement tending towards the protection of cultivated plants against parasitic diseases, and towards the protection of each country from the introduction from abroad of dangerous parasites. It is recommended that the next Phytopathological Conference should meet before the end of 1926 to discuss an international convention for the above purposes. The programme of the conference, on lines acceptable to all the countries concerned, should be drawn up by specialists (phytopathologists, entomologists, economists, and lawyers), keeping in view the final report of the Phytopathological Conference of Rome in 1914, the criticisms of that report in various countries, and the phytopathological legislation in force in each country.

This programme should be communicated to all the countries concerned six months before the meeting. It is further recommended that all countries should elaborate and enforce common measures for the protection of crops, including a State organization for the supervision and protection of crops, and an adequate number of well-staffed entomological and phytopathological research stations.

(2) On the proposal of L. Garbowski, of Bydgoszcz (Poland). It is suggested that the International Committee of Phytopathology and Economic Entomology [see this *Review*, iii, p. 412] should establish a periodical, to be published by the Plant Protection Association, in which would be recorded all outbreaks of important diseases and pests and the results of any experimental work on their control. The journal should in particular give information on the spread and intensity of the potato wart disease [*Synchytrium endobioticum*] in various countries and on the best measures for its control.

(3) On the proposal of A. Konečny, of Prague [Czecho-Slovakia]. In view of the difficulties caused to international trade in potatoes by the different, and often widely diverging, legislation in force in various countries concerning the sanitary condition of potatoes, their origin in localities free from wart disease (*S. endobioticum*), and the health certificates required with particular reference to this disease, it is recommended that this disease be considered by the International Committee of Phytopathology and Economic Entomology as extremely important from the international point of view, and that the Committee should start a movement for the unification of such legislation and certification. It is also recommended that wart disease be dealt with as a particularly important matter at the next International Phytopathological Congress.

PIASECKA (Mme Z.). **Ustawodawstwo ochrony roślin w Polsce.** [Plant protection legislation in Poland.]—*Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], Warsaw, i, 1, pp. 3–6, 1925.

This is a compilation of all the acts and ordinances in force up to date in Poland for the protection of cultivated plants and forest trees against invasion from abroad of new pests and diseases, and for combating those already existing in the country [see also this *Review*, iv, p. 128]. The only item of mycological interest is the Ordinance of 31st May, 1924, of the Minister for Agriculture, prohibiting the importation, as a measure against the introduction of *Synchytrium endobioticum*, of any potato tubers or plants, save under permit from the Ministry in the case of parcels duly certified by the plant protection authorities of the country of origin that such parcels are free from the disease.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

VOL. V MAY 1926

OLITSKY (P. K.). **The transfer of Tobacco and Tomato mosaic disease by the Pseudococcus citri.**—*Science*, N.S., lxii, 1611, p. 442, 1925.

Among several thousand tobacco and tomato seedlings kept in a greenhouse for a year and a half no case of spontaneous mosaic was observed. Over 200 of the plants were injured and infected with non-mosaic materials, with negative results. Further, 300 plants, grown from seeds from a mosaic tobacco plant, remained healthy. The disease, therefore, is not seed borne.

In June 1925 an infestation of the greenhouse with *Pseudococcus citri* occurred. A month later, 20 out of 50 uninoculated and unwounded tobacco plants infested with the mealy bugs showed typical mosaic symptoms. Twenty-four normal tobacco plants, similarly infested, were transferred to a field and after a month all developed mosaic, while 36 plants free from the insect remained normal under the same conditions. Of the 500 tobacco and tomato plants (40 injured) grown in the greenhouse after thorough disinfection, none contracted the disease. Seven out of nine tomato and three out of nine tobacco plants to which the insects were transferred after feeding on the diseased tissues developed typical mosaic symptoms after incubation periods of 10 to 21 days.

P. citri would appear, therefore, to be definitely implicated as a vector of the mosaic virus.

GARDNER (M. W.). **Cladosporium leaf mold of Tomato: fruit invasion and seed transmission.**—*Journ. Agric. Res.*, xxxi, 6, pp. 519–540, 1 fig., 5 pl., 1925.

The author has carried out cultural and biological studies of the tomato leaf mould fungus, *Cladosporium fulvum* [see this *Review*, v, p. 9], which causes serious damage to the fruit of greenhouse tomatoes, and (though to a much less extent than appears to be the case elsewhere) also to field crops in Indiana. In 1923 it severely attacked a greenhouse crop of Bonny Best tomatoes, causing a black stem-end rot and a blackened radial f[illegible]

tended to develop unevenly, one side being retarded in growth. Another striking symptom is the tenacity of the diseased fruits on the pedicels.

The blackened appearance of the base of the affected fruit is due to an intercellular mycelium just below the epidermis, formed of pseudoparenchymatous strands which mummify the host tissues and form a reticulum in which the cavities represent the original host cells. The hyphae also penetrate the whole thickness of the pericarp as far as the placenta, forming a less dense network than nearer the surface. The fibro-vascular bundles are not invaded. Spores are rarely produced on the fruit. In the larger intercellular spaces, sclerotial or perithecium-like bodies or bulbils, 150 to 300 μ in diameter, are formed, but these remain sterile except that those near the surface may bear tufts of conidiophores.

Cultures of the fungus obtained from the fruit readily infected the leaves, causing the typical mould lesions. Mycelial growth and spore germination occur between 10° and 30° C., with an optimum at 20° to 25°. Inoculation with spores showed that infection of the fruit occurs rather early through stomata in the sepals, torus, or last pedicel internode, after which the mycelium grows down into the fruit without rapidly killing the tissues. No stomata were found on the fruit, and attempts to inoculate even young fruits directly failed. Sepal infection is of common occurrence and is responsible for the one-sided stunting of the fruit. In one case of successful sepal inoculation, the fruit was examined 14 weeks later and it was found that abundant seed infection had occurred. Further studies showed that the mycelium frequently grows down the placentae and penetrates the seeds. Sclerotial bodies were found attached to the exterior of the hilum end of the seed coat, and also within the coats. The fungus penetrates as far as, but not into, the endosperm. Fragments of infected tissue may also adhere to the seed coat of seeds extracted from diseased fruits.

Under moist conditions the fungus sporulates on infected or contaminated seeds and the parasite may be introduced in this way into the seed bed. Transmission of infection to neighbouring seedlings may very easily take place, as the spores are frequently carried above ground on the cotyledons. Primary cotyledon infection has been observed in the seedlings grown in pots of sterile sand from both infected and surface-contaminated seed which had been dried for a month before sowing.

JØRGENSEN (C. A.). **To for Danmark nye plantesygdomme. 1. Fusarium paa Tomater.** [Two plant diseases new to Denmark. 1. *Fusarium* on Tomatoes.]—Reprinted from *Gartnertidende*, 2 pp., 2 figs., 1925.

Outdoor tomatoes of the Dansk Export variety at the Lyngby Phytopathological Experiment Station, Denmark, were attacked, during August and September 1925, by a disease with the following symptoms. A small, soft, sunken spot round the stigma rapidly spread over a large portion of the surface: at the same time the centre of the spot darkened and a white fungus mycelium appeared, frequently in the form of concentric rings. Finally the whole

fruit, penetrated by the fungus, became yellow and shrunken, and remained attached to the plant in a mummified condition.

The hyaline (pink in mass), falcate, four- to five-septate spores, which develop from the mycelium, were readily identified as those of *Fusarium erubescens*, first recorded in Germany about 1900 (see *Landw. Jahrb.*, xxxiv, p. 389, 1905) but not hitherto observed in Denmark.

Infection can only occur through wounds in the skin round the style. In an experiment at Lyngby, positive results followed inoculation on 32 per cent. of a number of wounded, unsprayed tomatoes, compared with 0 per cent. on unwounded fruit sprayed with Bordeaux mixture. In a lot which was neither sprayed nor wounded 4 per cent. became infected, while wounded, sprayed tomatoes showed 8 per cent. The low incidence of infection in the unwounded lots is regarded as negligible, being almost certainly due to the presence of small surface abrasions which were overlooked at the beginning of the test. The application of Bordeaux mixture is evidently of value in the control of the disease.

The early symptoms of attack being very inconspicuous on half-ripe fruit, diseased tomatoes are very liable to be stored with healthy fruit in frames or greenhouses, where the high temperature and extreme humidity promote the spread of infection. Spores adhering to the surface of healthy fruit also serve to propagate the disease. These conditions are very favourable to secondary attacks, which may also take place through the peduncle instead of being restricted to the stigma as in the growing plant.

Of 252 tomatoes gathered on 1st September, 13 were infected by *F. erubescens* alone and 74 more by this organism in conjunction with the potato blight fungus [*Phytophthora infestans*] or *Ascochyta* [*Didymella lycopersici*]. The outbreak started suddenly in the middle of August and reached its climax about the 22nd, when 70 per cent. of the fruit were found to be infected. With the cooler weather in late August and early September the symptoms declined in severity.

WILSON (M.). **The Phomopsis disease of conifers.**—*Forestry Comm. Bull.* 6, 34 pp., 12 pl., 1925.

Three distinct fungi appear to have been associated by various investigators [references to whose work are given] with diseases similar to that described in this paper, namely, (1) *Phoma pithya* Sacc. = *Sclerophoma pithyophila* (Cda) v. Höhn. = *S. pithya* (Sacc.) Died. = *Phomopsis pithya* Lind (in part) [see this *Review*, iii, p. 305]; (2) *Phoma abietina* Hartig = *Fusicoccum abietinum* Prill. et Del. = *Phomopsis pithya* Lind (in part) = *P. abietina* Grove (in part) [see this *Review*, i, p. 92]; (3) *Phomopsis pseudotsugae* Wilson = *P. pithya* Lind (in part) = *P. abietina* Grove (in part). The present paper is confined to the last of these.

The morphology of *P. pseudotsugae* is fully described. In the original accounts (*Trans. R. Scot. Arbor. Soc.*, xxxiv, p. 145, 1920; *Trans. & Proc. Bot. Soc. Edinburgh*, xxviii, p. 47, 1920) it was stated that both A- and B-spores (fusiform or elliptic and rod-shaped or curved, respectively) were present in different pycnidia, but it has since been ascertained that the spores formerly believed

which is almost constantly associated with *P. pseudotsugae* on young Douglas firs (*Pseudotsuga taxifolia*).

In a 16-year-old Douglas fir plantation the fructifications of *Diaporthe pithya* Sacc., not hitherto recorded in Britain, were observed on dead lateral branches. This fungus has also been found on young living branches of *Abies grandis*, producing symptoms similar to those caused by *P. pseudotsugae*. In order to investigate the possible connexion between the two organisms, ascospores and pycnospores of *D. pithya* were sown on Douglas fir decoction agar. A mycelium consisting of slender, septate, branched, hyaline hyphae, 2 to 3 μ in width, was produced, and in about three weeks pycnidia containing spores identical with those of *P. pseudotsugae* were developed. It is therefore considered highly probable that these two fungi are merely stages in the life-history of one species and inoculation experiments are in progress to establish this point.

In the original description of the *Phomopsis* disease [loc. cit.], two types of attack were distinguished, namely, die-back of the shoots and canker of the stems, the former being prevalent in nurseries and young plantations and the latter in older plantations. Extensive damage is frequently caused by cankering near the ground level in six- to ten-year-old plantations. In a six- to eight-year-old Perthshire plantation examined in the spring of 1920, about half the total number of trees were found to have been killed by the disease. The dead trees were replaced by fresh ones, but in the following September, 20 per cent. of the trees in the plantation, including some of the newly planted ones, were again affected. The bushy habit of the trees and absence of leaders in a plantation in the south of Scotland was also found to be due to the attacks of the fungus, which had successively destroyed the original leading shoot and three or four laterals developing in its place. Suppression of this type appears to be a frequent result of infection. In a 16-year-old plantation near Peebles at least 20 per cent. of a group of 300 trees showed cankers on the trunks and occasionally near the bases of the larger lateral branches. Near Dunkeld 19·6 per cent. of the 388 trees forming a 23-year-old plantation were attacked. The occurrence of the disease in groups was a noticeable feature in both these cases.

The symptoms of the disease on the Japanese and European larch (*Larix leptolepis* and *L. europaea*) [see this *Review*, i, p. 48], and on *Abies grandis* are briefly described. On the blue Douglas fir (*Pseudotsuga glauca*) and on *P. douglasii* var. *caesia* the symptoms are similar to those on *P. taxifolia*. A die-back of *Abies pectinata*, *Tsuga albertiana*, and *T. sieboldi* is also believed to be due to *P. pseudotsugae*.

Directions are given for the control of the disease, which in severe cases may appreciably weaken the timber, by thorough sanitation in the nursery and the exercise of great care in pruning to avoid wounds.

TUBEUF (C. v.). **Anbau oder Abbau von fünfnadeligen Kiefern.** [Cultivation or decline of five-needled Pines.]—*Allg. Forst- u. Jagdzeit.*, c, 3, pp. 89–100, 1924.

Basing his observations on an article by Harrer in the Yearbook of the German Dendrological Society for 1923, in which the substi-

tution of *Pinus monticola* for *P. strobus* in German forests is recommended, the author discusses some of the problems in connexion with the cultivation of five-needled pines in Germany.

P. monticola, together with *P. strobus* and *P. lambertiana*, was found by Klebahn to be attacked by blister rust (*Cronartium ribicola*) at Bremen in 1887–8. The disease, which was introduced into Germany on the Siberian *P. cembra*, was widely distributed with nursery stock not only in Europe but also in America, where it was previously unknown. On *P. monticola* its ravages have been so severe that the cultivation of this species is being abandoned in England. *P. peuce*, a native of the Balkan States, and *P. aristata* are also susceptible to the disease, while *P. excelsa* cannot survive the rigours of the German winter except in the southernmost regions. In view of the great susceptibility to blister rust of pines of the *strobus* group, Harrer's advocacy of *P. monticola* as a suitable tree for German forests appears misplaced.

Although the whole blister rust epidemic is believed to have originated on *P. cembra* from Russia, it was found that plantings of Alpine stock of this species remained healthy near diseased *P. cembra* at Leningrad. The single infection reported on this host from Switzerland is thought to have spread from an imported *P. strobus*.

Harrer's statements that blister rust is less injurious than is commonly represented, and that the disease was permanently eradicated from Prof. Mayr's experimental garden at Grafrath, near Munich, are also challenged. The disease has not only maintained its footing on *P. monticola*, *P. peuce*, and *P. cembra* (all of which are attacked quite as severely as *P. strobus*, if not more so), but it has recently appeared on *P. aristata*, and has spread to other gardens in the vicinity as well as to old plantings in the forest.

The disease is stated to flourish, under German conditions, in open stands, so that no protection is afforded by wide spacing. Saplings and the lower whorls of older trees are attacked with special intensity, but the uppermost branches of large trees are also affected.

In the writer's opinion, the further spread of blister rust in Germany can only be prevented by discontinuing the cultivation of *P. monticola* and *P. peuce* and restricting that of *P. strobus*. The importation of, and commerce in, five-needled pines should be prohibited, as in America. In cases where the retention of *P. strobus* is desirable on sylvicultural grounds, and where the risks of a spread of infection are too great, propagation should be effected exclusively by seed. Nurseries should be located at a distance of at least one to two hours' journey from dwellings and gardens, unless the growing of *Ribes* is entirely prohibited, similar restrictions applying also to forest plantings and individual trees. All infected individuals should be destroyed. Where currants are grown (and this should in no case be permitted in or near the nurseries) the immune Red Dutch variety [see this *Review*, ii, p. 483] should be distributed free from a State garden.

The organization of the Biologische Reichsanstalt für Land- und Forstwirtschaft is described, and suggestions are made for extended co-operation, primarily between Bavarian scientists and practical

forest workers, with a view to the solution of the blister rust problem.

Spaulding (P.) & Rathbun-Gravatt (Annie). **Conditions antecedent to the infection of White Pines by Cronartium ribicola in the north-eastern United States.**—*Phytopath.*, xv, 10, pp. 573–583, 5 graphs, 1925.

Recent investigations have shown that the factors influencing the period of production of the teleutospores of white pine blister rust (*Cronartium ribicola*) include weather conditions, time of season when the various *Ribes* hosts drop their leaves, and the capacity of the different species of *Ribes* to produce a second crop of foliage.

The germination of the teleutospores has been found to depend primarily on moisture. Low temperatures merely arrest the rate of germination. High temperatures have not been tested, but Doran's experiments with the aecidia and uredospores of the fungus (*Phytopath.*, ix, p. 391, 1919) indicate that they may inhibit germination even in the presence of water. As the teleutospores mature the time required for their germination is increased.

Factors affecting the longevity of the teleutospores (i. e., time during which they remain ungerminated and still viable) include the habitat of the *Ribes* hosts and the structure of their leaves, both of which are closely connected with the access of moisture to the teleutospores.

The results of field experiments have shown that infection of white pines by *C. ribicola* must be preceded by a period of sufficient moisture (minimum five hours) to germinate the teleutospores, which in its turn must be followed by a period of high humidity (23 hours) during which infection can actually take place. The known minimum period for the beginning of infection is 11½ hours after the germinating sporidia are deposited on the leaves of the pines. Varying combinations of weather conditions, which may be presumed to result in more or less heavy infection, are illustrated by graphs, and some of the numerous problems awaiting solution are briefly indicated.

Snell (W. H.) & Rathbun-Gravatt (Annie). **Inoculation of Pinus strobus trees with sporidia of Cronartium ribicola.**—*Phytopath.*, xv, 10, pp. 584–590, 2 figs., 1925.

A description is given of the method used in inoculating large white pine (*Pinus strobus*) trees with blister rust (*Cronartium ribicola*) collected from *Ribes nigrum*, *R. odoratum*, and *R. cynosbati* at North Conway, New Hampshire, in 1922.

The trees, ranging from five to thirty years old, were situated in a region from which the *Ribes* had been eradicated in 1916. Prior to inoculation the branches were sprayed with water, the portions of *Ribes* leaves with germinated teleutospores subsequently being loosely fastened round the needle clusters. After another water spray, the branches were inserted in moist chambers for 24 to 36 hours. This method was used for 144 branches on 51 trees. Fifty-three additional branches on nine of the same trees were inoculated

under extremely humid conditions without subsequent insertion in moist chambers.

On examination in 1924, eighteen of the trees inoculated in moist chambers had become diseased and twenty branches had developed cankers. Six of the trees inoculated under natural conditions had become diseased, and had formed cankers on eleven branches. Since the incubation period of *C. ribicola* sometimes extends over several years, later inspections may reveal considerably more infection.

These results are considered of some importance as representing the first successful inoculation of large white pines with *C. ribicola.*

SPAULDING (P.). **A partial explanation of the relative susceptibility of the White Pines to the White Pine blister rust (Cronartium ribicola Fischer).**—*Phytopath.*, xv, 10, pp. 591–597, 1925.

It has been shown (*Conn. Agric. Exper. Stat. Bull.* 214, p. 428, 1919) that most of the infection of the different species of white pines by blister rust (*Cronartium ribicola*) starts in the leaves, which are penetrated through the stomata. It has also been determined that the fungus takes several months to reach the bark of the twig, after infection is established within the leaf. On *P. strobus* and *P. monticola* a considérable percentage of all infections takes place through the older leaves. With *P. strobus*, there is a chance that the older infected leaves may drop before the fungus reaches the bark, while in the case of *P. monticola*, which retains its leaves a year longer, a much larger proportion of the infections are likely to reach the twig. Considering only leaf casting, those species of pines which retain their leaves for longer periods would thus be expected to prove the most susceptible. The preliminary results of a study of relative susceptibility confirm this hypothesis in respect of the very susceptible and susceptible groups of white pine (the former including *P. monticola* and the latter *P. strobus*), the average leaf persistence being decidedly longer in the first than in the second group (ratio about five to three years). In the resistant and immune groups, however, there is no correlation between susceptibility and leaf persistence, so that in these some other factor is evidently more important.

It has further been shown that all the very susceptible species (*P. monticola*, *P. flexilis*, and *P. albicaulis*), and three of the five susceptible (*P. ayacahuite*, *P. lambertiana*, and *P. strobiformis*) have stomata on both the inner and outer sides of the leaves. This is true also of two species of the resistant group (*P. excelsa* and *P. koriaensis*), but it is pointed out that the evidence of resistance in this group requires further testing. In these three groups there appears to be a certain degree of correlation between the distribution of the stomata on the leaves and the degree of susceptibility.

There is stated to be reliable evidence that the fungus develops more profusely in the thick bark of *P. monticola* than it ever does in that of *P. strobus*, and the writer believes that this is directly due to the greater abundance of phloem in the former. *P. strobus*

frequently dies from the girdling of the stem, whereas in *P. monticola* death is the direct result of the destruction of the twigs.

GILL (L. S.). **Peridermium harknessi Moore in Western Yellow Pine tops.**—*Phytopath.*, xv, 10, p. 617, 1925.

In October 1924, a number of galls of *Peridermium harknessi*, which generally attacks seedlings and young trees most severely, were found on a group of four or five western yellow pines [*Pinus ponderosa*], 100 ft. in height, in the Stanislaus National Forest, California, at an elevation of 5,000 ft. The fungus was also detected on two trees 150 ft. in height at a distance of 50 and 125 yards from the first group. The infected trees were situated in a mature stand of mixed sugar pines [*P. lambertiana*] and yellow pines. During the logging operations from July to October 1924, every felled pine on a hundred acres of the site was examined, and constant attention was also paid to the pathology of the young growth. No more *Peridermium* galls were observed, and no trace of a *Cronartium* was found. Infection is believed to have originated with chance sporidia or aecidiospores carried in from the outside.

VANINE (S. I.). О двух новых для Ленинградской губ. грибках, повреждающих молодые Сосны. [First record from the government of Leningrad of two fungi injurious to young Pines.]—*Bull. Leningrad Inst. of Forestry*, xxxii, pp. 181–188, 1 fig., 1925. [German summary.]

This is the first record from the government of Leningrad of *Phacidium infestans* and *Hypodermella sulcigena* [see this *Review*, v, p. 197], which were found attacking 6- to 10-year-old pines in the Ossinovoroshtshinskaya Datcha [estate] of the Pargoloff Forestry Circuit in the autumn of 1923.

Phacidium infestans was found parasitizing the needles chiefly on the lower branches of the pines which had been covered by snowdrifts during the winter. Smaller seedlings, not over one yard high, were occasionally attacked throughout. The fungus killed the infected needles, and passed from them into the cortical tissues, chiefly into the resin ducts, of the twigs, which also finally perished. The dead needles turn a greenish-grey colour, and remain for a long time attached to the branches. Later, numerous elongated, light coloured, slightly erumpent apothecia of the fungus cover both sides of the dead needles. The question is still open whether this fungus is a true or facultative parasite. Occasionally it was found in association with *P. lacerum* Fr., which is easy to distinguish from the former by its morphological characters.

Hypodermella sulcigena is said to be a new record for Russia. It was found attacking a fairly large number of the pine seedlings, particularly along the borders of the different plots, but the injury done by it was slight, as it only killed the apical portion of the needles. On the majority of the needles infected were found narrow, greyish-black, slightly raised perithecia, up to 8 mm. in length. The latter contained elongated asci, slightly tapering at both ends and from 105 to 135 by 12 to 18 μ in diameter, and also numerous filiform paraphyses, from 1·5 to 2 μ broad. The asci

always contained eight club-shaped, hyaline spores, 32 to 45 by 4·5 to 6 μ in diameter. Each spore was enveloped by a hyaline, strongly refractive, jelly-like mass.

Control measures against both fungi should consist in the removal and destruction of the infected needles, and in the pruning of the twigs bearing diseased needles.

BAXTER (D. V.). **The biology and pathology of some of the hard wood heart-rotting fungi.**—*Amer. Journ. of Botany*, xii, 8, pp. 522–552; 9, pp. 553–576, 4 pl., 1925.

The author's studies on the heart rot of various trees [see this *Review*, iii, p. 497] have been continued, especially in regard to the question of advance infections and the biological relations between the mycelia and their hosts. Cultural studies of several heart-rotting fungi were also carried out.

The following fungi and hosts were studied: *Polyporus hispidus* on *Fraxinus nigra*; *Fomes fraxinophilus* on *F. americana*; *F. fraxinophilus* f. *ellisianus* n. f. on *Shepherdia argentea*; *F. applanatus* on *Morus rubra*; *F. connatus* on *Nyssa sylvatica* and *Acer rubrum*; *F. everhartii* on *Quercus velutina*, *Q. rubra*, and *Q. alba*; *F. igniarius* on *Fagus grandifolia*; *F. pomaceus* f. *crataegi* n. f. on *Prunus americana* and *Crataegus* sp.; *F. conchatus* on *F. nigra* and *Crataegus* sp.; and *Hydnum septentrionale* on *A. rubrum*.

P. hispidus was successfully cultured on blocks of heartwood of black ash (*F. nigra*), white ash (*F. americana*), red oak (*Q. rubra*), yellow birch [*Betula lutea*], and apple wood [see this *Review*, iv, p. 446]. The colour of the mycelium on the different woods was practically identical in all cases, namely, antimony yellow to buckthorn brown (Ridgway's Color Standards). The amounts of decay produced in the different species in one year, as represented by loss in oven-dry weight, under controlled conditions, were as follows: white ash, 19·2 per cent.; black ash, 17·1 per cent.; yellow birch, 24·4 per cent.; red oak, 10·5 per cent.; and apple, 15·9 per cent. In white ash the rot was characterized by a chalky appearance of the wood and dark brown lines on the surfaces of the blocks; the symptoms in black ash were similar but less pronounced. Decayed yellow birch wood turned yellowish-brown, and the annual rings were unusually sharply defined. Here also the occurrence of dark lines was a striking feature of the rot. Little change was observed in the appearance of the infected oak blocks. The exterior parts of the rotted apple wood were converted into a crumbly, whitish-yellow mass, and irregular dark-brown lines were formed. Lamination of the medullary rays was also observed. Tests with black ash showed that the fungus could attack sapwood equally with heartwood.

Positive results were given by field inoculations on living white and black ash trees with *P. hispidus* from black ash. The rot is mainly confined to the upper part of the bole in standing trees, and inoculations showed that sprouts without heartwood are susceptible to attack. The extension of the mycelium in the living tree seems to be very slow.

F. everhartii is stated to be the most important oak rot in

Michigan, frequently occurring in an epidemic form on *Q. rubra* and *Q. velutina*. Both heart- and sapwood are attacked, and the rot may occur in any part of the trunk or limbs (generally near the ground), sometimes even extending into the roots. The wood substance is eventually reduced to a crumbly consistency. The badly decayed regions are frequently bordered by a discoloured zone of wood. The cells between the medullary rays may be partially or totally destroyed by the hyphae. Strength tests were carried out on blocks of *Q. alba*. The average crushing strength of 28 apparently sound blocks taken from the centre of the trunk within the ring of visible decay was 12,624 lb. compared with 12,937 lb. in the case of 8 blocks from sound trees.

F. everhartii was shown to be able to grow freely on badly decayed poplar wood and, with a few exceptions, the wood-destroying fungi ordinarily found on living trees can continue growth saprophytically in the dead wood under favourable moisture conditions. In such cases the wood may become blackened in sharply defined lines in a manner similar to that observed in the living tree, indicating that wound gum is not produced solely as a reaction of the living tissues.

The white wood rots caused by *F. everhartii* and *F. igniarius* are stated to be almost indistinguishable in nature on frondose trees. In culture, however, the two fungi develop very differently. The mycelium of *F. igniarius* on rotted beech is floccose, somewhat tuberculate, and buckthorn brown in colour, whereas that of *F. everhartii* is radial, with parallel, fibrillose hyphae, and buff yellow to carob brown in mass.

H. septentrionale reduces the wood of beech and maple to a white, soft, pulpy substance. Radiating lines formed by bands of resistant medullary ray cells are characteristic of this rot in maples. The decayed areas are bordered by a dark brown zone of firm wood which contains mycelium. In advanced stages the corroded wood fibres and medullary ray cells are practically the only elements left. Only a few isolated hyphae, which seem to be incapable of growth, are found in very rotten wood.

The white rot due to *F. conchatus*, which is stated to be very prevalent on black ash throughout Michigan, generally occurs in irregular pockets, the intervening wood being apparently sound but really containing hyphae.

F. connatus is stated to be of common occurrence on maples (*Acer*), but was not previously known on sour gum (*Nyssa sylvatica*). Diseased specimens of *A. rubrum* and *A. saccharum* were felled and examined. The butt logs of both trees were partially hollowed out and bore the fructifications of the fungus. The dark brown, stringy, decayed portions were bordered by a dark zone extending into the light sapwood in finger-like irregularities. Mycelium was found in the rotten areas, in the bordering zone, and (on microscopic examination) at a distance of 27 mm. outside the latter. The decay in *N. sylvatica* was similar.

Field and laboratory observations [which are summarized] on *F. fraxinophilus* and the fungus usually known as *F. ellisianus* indicate that they must be considered as a single species, the latter being renamed *F. fraxinophilus* f. *ellisianus*. Blocks of the buffalo

berry (*Shepherdia argentea*) inoculated with the former showed a loss in weight of 17·6 per cent. compared with 11·9 for the latter, the corresponding figures for white ash being 19 and 18·5 per cent. In both hosts the heart- and sapwood are attacked.

F. pomaceus f. *crataegi* n. f. [an English diagnosis of which is given] produces an irregular, radial decay of the heart- and sapwood of various species of *Crataegus* and of *Prunus americana*. The sound spring wood stands out in the form of slight ridges. The absence of concentric black zones or lines is a conspicuous feature of this rot, which is further characterized by an abundant production of mycelium throughout the decayed areas. In culture the mycelium is floccose, later lacunose, and maize yellow, subsequently cinnamon brown.

The hyphae of *F. applanatus* on mulberry were found to extend 5 cm. from the noticeably decayed areas. The absence of black lines, which are usually a conspicuous feature of decay by this fungus, is of interest in this case.

VANINE (S. I.). Основания для диагностики гнилей древесных пород, вызываемых грибами, и таблица для определения гнилей главнейших лесных пород России. [Principles for the diagnosis of tree rots caused by fungi, and table for the determination of the rots of the chief species of forest trees in Russia.]—*Bull. Leningrad Inst. of Forestry,* xxxii, pp. 165–180, 7 figs., 1925. [German summary.]

This is an attempt to classify fungal rots of trees by their macroscopical symptoms, namely: (1) location of the rot in the stem; (2) colour of the rot; (3) alterations caused by the rot in the physical structure of the wood; (4) the presence or absence of 'black lines' in the infected wood; (5) the presence or lack of 'wundkern'; and (6) the colour, shape, and consistence of the mycelium developing in the fissures in the rotted wood.

According to their location in the stem, the rots are divided into: heart rots (e. g., *Fomes igniarius*); peripheral rots, i. e., those spreading from the periphery inwards (e. g., *Irpex fusco-violaceus*); and mixed rots, i. e., those that start from the periphery and advance inwards very irregularly, so that, while the heartwood is attacked, there remain sound portions of the peripheral wood (e. g., *Polyporus betulinus*). By their colour the rots are classed into light-coloured, i. e., yellowish and white, rots (e. g., *Fomes igniarius*), and dark-coloured, i. e., blackish-brown and red, rots. The latter are distinguished into unicoloured (e. g., *Polyporus sulphureus*) and variegated [chequered] (e. g., *P. dryadeus*). In regard to the alterations produced in the structure of the wood, the following classification is established: (1) laminated rots (e. g., *Fomes fomentarius*); (2) cubical rots (e. g., *P. sulphureus*); (3) fissured rots (e. g., *P. borealis*); (4) cavity-forming rots (e. g., *Stereum frustulosum*); and (5) powdery rots (e. g., *P. betulinus*).

The 'black lines', 'wundkern', and the colour of the mycelium growing in the fissures are said by the author to be suggested for the first time as macroscopical diagnostic symptoms of the rots.

The paper concludes by a tabular key for the determination of the different fungous rots of forest trees occurring in Russia. It is

divided into three headings: rots of conifers, rots of the oak, and rots of broad-leaved trees other than the oak.

KILLIAN (C.). **Le Gyroceras celtidis Mont. et Ces. parasite du Celtis australis L.** [*Gyroceras celtidis* Mont. and Ces. parasitic on *Celtis australis* L.]—*Bull. Soc. Hist. Nat. Afrique du Nord*, xvi, 8, pp. 271–281, 4 pl., 1925.

In this paper an account is given of the author's study of the development of *Gyroceras celtidis*, a common parasite of the leaves of *Celtis australis* in the neighbourhood of Algiers.

Cultures on malt agar produce an aerial mycelium with rounded, uninucleate conidia in small chains curved at the free end, and an immersed mycelium bearing minute pycnidia; the latter are globular, with thick brown walls and a lighter coloured core, and contain at maturity a large number of pycnospores, 2·5 μ in diameter, that escape through an ostiole. Inoculation experiments showed that infection occurred solely through the lower surface of the leaves, producing small, yellowish, translucent spots, that later increased somewhat in size and assumed a greyish tinge; at a still later stage, a brown conidial efflorescence appeared in the centre of the spots and gradually extended over almost the whole of the leaf, which then fell off. Microscopical examination showed that the mycelium in the leaf tissues was intercellular.

On the dead leaves, both in the laboratory and in nature, pycnidia and perithecia were found. The perithecia are developed in small, black sclerotia, hardly visible to the naked eye, with a thick envelope consisting of thick-walled cells and a core composed of a thin-walled plectenchyma. They correspond in all respects to the diagnosis of *Sphaerella* [*Mycosphaerella*] *celtidis* Passerini, of which *Gyroceras celtidis* is regarded as the conidial stage.

OWENS (C. E.). **A Tubercularia canker of Chinese Elm.**—Abs. in *Phytopath.*, xv, 11, p. 729, 1925.

A canker of Chinese elms (*Ulmus pumila*) was observed in May 1925 in the nursery of the forestry school at Oregon Agricultural College, several trees being completely girdled and dying. The conidial stage of the fungus, a species of *Tubercularia* apparently identical with the imperfect stage of *Nectria cinnabarina* [see this *Review*, iii, p. 507], was abundant on the surface of the cankers. The perfect stage was not observed. The fungus apparently enters at pruning wounds, but once established it acts as a virulent parasite.

LUTZ (L.). **Sur la spécificité de quelques Hyménomycètes épiphytes vis-à-vis de leurs supports.** [On the specific relation of some epiphytic Hymenomycetes to their hosts.]—*Bull. Soc. Myc. de France*, xli, 3, pp. 345–357, 1925.

This is an account of the author's studies on the specificity of some epiphytic Hymenomycetes in regard to their substrata, incorporating the results reported in his two previous papers already noticed [see this *Review*, iv, p. 515], together with details of similar experiments with *Pleurotus nebrodensis*. In a brief discussion of the nature of the substances that inhibit the develop-

ment of fungi on certain natural substrata, and the removal of which (either by lixiviation or with the help of solvents) allows the fungi to develop freely on these substrata, he draws a parallel between the attacks of fungi on living plants, and of bacterial and mycotic pathogens on animals. In both cases the host must be rendered receptive by the breaking down of its natural resistance in order to allow the disease to become established.

Mention is also made of the fact that when *Corticium quercinum* was cultivated on beech wood, it produced a large number of orange-yellow, easily detachable sporophores, greatly resembling the fruiting bodies of a *Stereum*. The author suggests that many fungi, on passing to a new substratum, may change the outward characters of their fructifications to such an extent as to lead to their being diagnosed at first sight as distinct species.

RAMSEY (G. B.). **Sclerotinia species causing decay of vegetables under transit and market conditions.**—*Journ. Agric. Res.*, xxxi, 7, pp. 597–632, 7 pl., 3 graphs, 1925.

The investigation reported in this paper was undertaken with a view to determining the species of *Sclerotinia* involved in a soft, watery, and odourless rot [the symptoms of which are described] that is responsible in the United States for very important losses to a wide range of market-garden produce both during transit and in storage. Instances are cited when such produce (especially if harvested in wet weather), though apparently sound at the time of despatch, showed a high percentage of decay due to these organisms upon arrival on the market after a transit of no more than four days in adequately cooled cars.

The extensive material examined in the Chicago market from practically every part of the United States included cabbage and its allies, beans, peas, celery, asparagus, lettuce, cucumber, carrots, parsnips, turnips, and sweet potatoes. The affected consignments showed a white, cottony mycelium and bore typical sclerotia. Morphological studies showed that all the large (averaging 3·5 mm. in oatmeal agar cultures) sclerotial forms found (about 90 per cent. of all the isolations) belonged to *S. sclerotiorum*, the smaller forms belonging to *S. intermedia* (average 2 mm.) and *S. minor* (average 0·78 mm.). Cross-inoculations showed that these three species, and also *S. ricini*, practically have the same wide range of hosts, and as the decay produced by them is identical (with the exception of that caused by *S. ricini*), the species can be distinguished only by the peculiarities of mycelial or sclerotial growth in culture, or apothecial characters. Apothecia were best obtained by planting mature sclerotia 5 to 10 mm. deep in sterile, moist sand in rather strong light. They developed in from 18 to 141 days.

Cultural studies indicated that, for all the species investigated, there is no difference between cultures raised from sclerotia and from mycelium, other than variations in the rate of growth. At temperatures approaching the minimum and the maximum for each strain, there is a tendency to produce sclerotia respectively larger and smaller than normal for room temperature; on favourable culture media the sclerotia formed are larger than those formed on unfavourable media. Small sclerotia are especially susceptible to

decay if kept too moist, and the author believes this to be one of the reasons why it is usually much more difficult to obtain apothecia from *S. intermedia* and *S. minor* than from *S. sclerotiorum*.

All the strains tested produced microconidia resembling those of *Botrytis*, the amount of available food apparently being the chief factor in determining the moment of their production; media unfavourable for the vegetative growth of the fungus appeared to stimulate a rapid and abundant production of these bodies. Although the author was successful in inducing the microconidia of several strains to germinate, his experiments indicate that they do not play any important part in the life-history of the organisms.

Artificial infection was readily obtained with sclerotia and mycelium, both through wounded and sound surfaces, under favourable moisture and temperature conditions. Direct infection by ascospores was also secured on wounded lettuce leaves and cut turnip and carrot roots.

Inoculation studies and plate cultures showed that all the species of *Sclerotinia* were able to grow and cause infection at temperatures as low as $-0{\cdot}5°$ to 0° C. *S. intermedia* grew fastest and produced most decay at this temperature, while at 20° C. the greatest damage was done by *S. minor*. At temperatures of 32° to 33° all the strains (with the exception of *S. intermedia*, which ceases growth at 30° to 31°) made slight growth on potato-dextrose agar, but inoculations at this temperature gave negative results. Ascospores germinated readily in sterile water and nutrient solutions at temperatures ranging from 3° to 31°.

Experiments showed that although incipient infections may develop some decay in transit at temperatures of 40° to 45° F., new infections and the spread of the rot from one plant to another during the most usual transit period will be fairly controlled at these temperatures, especially if the produce despatched is sound and has been pre-cooled before shipment.

GREGORY (C. T.). **Cabbage diseases in Indiana.**—*Proc. Indiana Acad. Sci.*, xxxiv (*1924*), pp. 283–284, 1925.

Cabbage yellows [*Fusarium conglutinans*: see this *Review*, v, p. 74], which was first observed at Indianapolis in 1897, is stated to have become a limiting factor in cabbage growing throughout Indiana. In 1917 the resistance of the Wisconsin Brunswick and Wisconsin Hollander varieties was demonstrated, and in 1919 Wisconsin All Seasons and Wisconsin Succession were added to the list. Over 2,000 farmers and gardeners in 52 counties are stated to be using these varieties regularly. A highly resistant strain of the Louisville Drumhead variety has also been developed.

Heavy losses are also caused by blackleg (*Phoma lingam*), which has been known to destroy entire fields, and on one farm at Indianapolis takes an annual toll of 25 to 40 per cent. of the crop. This disease has been successfully controlled by Walker's hot water treatment [see this *Review*, iii, p. 74], with very little reduction of germination (5 to 7 per cent.). Plants from treated seed were grown

in 1924 on infected and healthy soil, developing 25 and 0 per cent. of blackleg, respectively.

A serious rotting of the seed stalks was found to be due to the penetration of certain organisms through the leaf scars. Before the seed heads were transplanted in 1923, 28 were thoroughly sprayed with 4–4–50 Bordeaux mixture, while 69 were left untreated. In May 1924, 33 of the latter were dead or dying as a result of the decay, while 25 of the sprayed plants were thriving. By July all the untreated plants were dead, while the sprayed ones were producing a good crop of seed.

NICOLAISEN. **Bodendesinfektion zur Bekämpfung der Schwarzbeinigkeit der Kohlpflanzen.** [Soil disinfection for the control of blackleg of Cabbage plants.]—*Provinzialsächs. Monatsschr. für Obst-, Wein-, u. Gartenbau*, 6, 1925. [Abs. in *Nachr. Landw. Abteil. Farbenfabriken vorm. F. Bayer & Co., Leverkusen bei Köln-am-Rhein*, iv, 4, pp. 135–136, 1 fig., 1925.]

Excellent control of 'blackleg' [damping-off] of cabbage and other cruciferous seedlings [*Pythium de Baryanum*, &c.] is stated to have been obtained by strewing uspulun or germisan bolus on the beds and working it well into the soil. The writer now disinfects all beds before planting with one of these preparations, since failure constantly results where this precaution is omitted.

GÉRAY. **La pourriture bactérienne du Chou-fleur.** [The bacterial rot of Cauliflower.]—*Journ. d'Agric. Prat.*, lxxxix, 51, pp. 501–502, 1925.

A recent outbreak of bacterial rot (*Bacillus brassicaevorus*) is stated to have destroyed about half the cauliflower crop at Marais de Sin-le-Noble, near Douai [Nord]. This disease was first observed in the same locality in 1904–5, when it caused a loss estimated at 2,000,000 francs. The causal organism appears to have gradually decreased in virulence and the industry was replaced on a profitable basis until again threatened by this fresh epidemic.

The disease appears a few weeks after planting in the form of small cankers on the petioles and leaf sheaths, which gradually extend to the terminal bud. Mature plants may also be affected. In warm, wet, and stormy weather the disease makes rapid progress and may destroy an entire crop in 48 hours. During the outbreak of September 1925 losses amounting to 20, 50, and 80 per cent. occurred in various market gardens.

Varieties of cauliflower with a high water content, such as Leconte and some of the Buselings, have been found particularly susceptible to bacterial blight; red and head cabbage are resistant and Brussels sprouts appear to be immune.

Delacroix and Griffon, who studied the disease on its first appearance, ascertained that infection is transmitted by the soil and recommended the adoption of suitable cultural measures, together with the application of fertilizers containing phosphates and potassium. An analysis of the infected soils further revealed a complete absence of sulphur, a condition which was thought to predispose the

plants to the disease. It is suggested that much benefit might be derived from the application of such compounds as carbon disulphide, sulphuric acid, sulfarine (stated to have been efficacious in the control of potato scab [*Actinomyces scabies*]), polysulphides, crude ammonia, and carbon tetrachloride.

The development of resistant varieties is also indicated as a possible means of control.

CARSNER (E.). **A Bean disease caused by the virus of Sugar Beet curly top.**—Abs. in *Phytopath.*, xv, 11, pp. 731–732, 1925.

A severe epidemic occurred in the bean crop of Twin Falls County, Idaho, in the spring of 1924, local accounts of which suggested that the disease was of the mosaic type. In order to ascertain whether the leafhopper (*Eutettix tenella*), the agent of transmission of the curly top disease of sugar beets [see this *Review*, v, pp. 74, 75], was implicated in the spread of infection, bean plants of two varieties were grown in the greenhouse and inoculated with curly top virus. The plants on which infective leafhoppers were caged developed marked symptoms of the disease, while those on which non-infective insects were caged remained healthy. The virus was recovered from the diseased beans and transmitted to healthy sugar beets by means of previously non-infective leafhoppers. A difference in varietal susceptibility to the disease was indicated, and field inoculations are in progress with seven varieties to secure further information on this point.

FAWCETT (G. L.). **Encrespamiento de las hojas de la Remolacha Azucarera.** [Curly leaf of Sugar Beet.]—*Rev. Indust. y Agric. de Tucumán*, xvi, 3–4, pp. 39–46, 9 figs., 1925.

A description is given of the symptoms of curly leaf or curly top of sugar beet in Tucumán (Argentine Republic), where the disease appears in a milder form than in the United States, and a detailed account of the author's experiments to determine the agent of transmission in that locality. This was found to be the leafhopper *Aceratogallia sanguinolenta*, a jassid closely resembling *Eutettix tenella*, which is responsible for the transmission of the similar disease in North America [see last abstract]. *E. tenella* has not been found in Tucumán, although it is recorded in southern Argentina, where it is associated with a form of beet curly top agreeing with that in North America [see this *Review*, iii, p. 290]. It is interesting to note that although *A. sanguinolenta* is known to be prevalent on beets and other plants in North America, it is not considered to be a serious pest in that area.

The marked necrosis of the phloem, which is visible as a dark ring in cross sections of the root in the *E. tenella* curly top, is not found in the form carried by *A. sanguinolenta*. Apart from this, the symptoms are identical and similar means of control should be applicable in both cases. Spraying has proved ineffective. Early planting is advised with a view to producing well-developed plants at the time of attack. No positive statement can yet be made as to the resistance of spring-sown as compared with autumn-sown crops, but the latter appear to be relatively free from the disease. Due attention should be given to the avoidance of other host

plants of the vector in proximity to the beet plantations, from which the disease might be transmitted [see also this *Review*, v, p. 75].

RAWLINS (T. E.). **A Myxomycete occurring in the smaller roots of Beets.**—Abs. in *Phytopath.*, xv, 11, p. 727, 1925.

A heavy infection by a Myxomycete has been consistently observed, generally in the multinucleate plasmodial stage, in the cortical cells of the smaller roots of greenhouse sugar beets. The plasmodium later becomes differentiated into a mass of thick-walled, hexagonal spores which presumably liberate zoospores after the death of the host. An *Olpidium*-like form and a thick-walled resting stage have also occasionally been found in infected roots, but these are not yet definitely known to be stages in the life-cycle of the organism, which is believed to be identical with *Sorolpidium betae* Nemec.

SHEVTCHENKO (L.). **Ascochyta betae Prill. & Delacroix.**—*Листок Боротьбы з Шкідниками. Бюл. Київськой Станції Захисту Рослин від Шкідників* [*Pest Control Circular.—Bull. Kieff Plant Prot. Stat.*], 4, pp. 29–30, 1925. [In the Ukrainian language.]

The author records the simultaneous occurrence in the spring of 1924, among other micro-organisms found on samples of sugar beet seed from Proskouroff [Ukraine], of fructifications of *Phoma betae* and *Ascochyta betae.* The losses caused by these fungi to the seedlings raised from the infected seed amounted to 5 to 8 and 47 to 50 per cent., respectively, both in commercial crops and in experimental plots.

The joint presence of the two organisms on the same seed clumps at first led to some confusion since their fructifications are very similar outwardly. The spores differ chiefly in size, those of *Phoma betae* being 4 to 6 by 2 μ and those of *Ascochyta betae* 9 to 12 by 2·5 to 3 μ according to Rabenhorst, while the author's measurements were 6 to 12 by 2·5 to 3 for the latter. The spore septation characteristic of *Ascochyta* is at first absent and only appears at a late stage, especially when the spores are germinated in a hanging drop.

On the ground of his discovery of *A. betae* on the seed clumps and the ease with which the two organisms may be confused, the author believes that many cases of beet seedling root-rot, hitherto attributed to *Phoma betae,* are really caused by *Ascochyta betae.*

WALKER (J. C.). **Two undescribed species of Botrytis associated with the neck rot disease of Onion bulbs.**—*Phytopath.*, xv, 11, pp. 708–713, 2 figs., 1925.

The neck rot diseases of onion, especially as they occur in the middle western United States, have been under investigation since 1917. In addition to *Botrytis allii* [see this *Review*, iv, p. 519], two other distinct and apparently undescribed species of *Botrytis* have been found commonly associated with neck rot. The three types of rot are designated as (1) grey mould neck rot (*B. allii*); (2) mycelial neck rot (*B. byssoidea* n. sp.), stated to be the most important cause of the disease in Wisconsin and Illinois; and (3)

small sclerotial neck rot (*B. squamosa* n. sp.), which has so far been found only on the dry outer scales of the bulbs of white varieties.

English diagnoses of the new species are given. *B. byssoidea* is characterized by a hyaline, septate mycelium of variable diameter, the branches sometimes slightly constricted at the base. The conidiophores are erect, later flattened and twisted, hyaline at the growing tip, slightly swollen at the base, with walls becoming deep brown with age. The hyaline, sporiferous branches, formed at the growing tip, rebranch and produce, upon short, hyaline sterigmata, obovoid, smooth, continuous, ashen-grey conidia, measuring on an average 10 to 14 by 6 to 9 μ. Globose microconidia, about 3 μ in diameter, borne on short, hyaline conidiophores, are also formed. The main trunk proliferates and is marked by scars where the earlier sporiferous hyphae have disappeared. White (later black), irregular sclerotia are developed, measuring 1 to 5 mm. or more, and with dark walled outer and hyaline interior cells. On germination they may produce hyaline hyphae or conidiophores.

The hyphae of *B. squamosa* are not ordinarily constricted at the base, and are erect, later flattened, hyaline, septate, and branched. The conidiophores are comparatively rare at 20° to 22° C., more abundant at lower temperatures, generally arising in tufts from the roughly circular, flat, scale-like sclerotia, 0·5 to 4 mm. in diameter; their growing tips branch repeatedly prior to sporulation and bear obovoid to ellipsoid, smooth, continuous, hyaline, ashen-grey conidia, 15 to 20 by 12 to 15 μ, on short, hyaline sterigmata. The microconidia are identical with those of *B. byssoidea*. The lateral branches of the conidiophore degenerate after fructification, their walls drawing back in characteristic, accordion-like folds, leaving scars on the main stalk.

The cultural characters of each of these three species of *Botrytis* are briefly described.

RAWLINS (T. E.) & McCLAIN (R. L.). **Tip-burn and 'slime' diseases of Lettuce in California.**—Abs. in *Phytopath.*, xv, 11, pp. 727–728, 1925.

Lettuce plants showed earlier and more severe symptoms of tipburn [see this *Review*, ii, p. 528] at high than at low moisture contents. Plants grown in culture solutions were also severely affected. These experiments indicate that tipburn cannot be controlled by increasing the water supply at the surfaces of the roots. Cytological studies of the disease in its earliest stage show that the first degeneration usually occurs in the cells adjacent to the vessels at the junction of small marginal veins, denoting a close correlation between the transpiration stream and the disease. In general, tipburn appears to be favoured by any condition promoting succulence in the plants. Affected tissues are very liable to invasion by *Botrytis* sp. or bacteria, which produce destructive rots known locally as 'slime'.

SWINGLE (D. B.). **Center rot of 'French Endive' or wilt of Chicory (Cichorium intybus L.).**—Abs. in *Phytopath.*, xv, 11, p. 730, 1925.

Two types of chicory rot are under investigation at the Montana

Agricultural Experiment Station, namely, centre rot, affecting chiefly the young inner leaves which become yellowish-olive in colour, and superficial rots usually beginning on the older leaves. Two bacteria have repeatedly been isolated from leaves attacked by the former type of decay, and on inoculation each of these is capable, independently, of producing the typical symptoms. They have been named *Phytomonas cichori* and *P. intybi.* Both are non-spore-forming rods with polar flagella, Gram-negative, indol-negative, not hydrolyzing starch, and with a thermal death-point of 51° C. *P. intybi* liquefies gelatine and reduces nitrates while *P. cichori* does neither.

BOTKE (J.). **Andijvie- en Cichoreiroest.** [Endive and Chicory rust.]—*Tijdschr. over Plantenziekten,* xxxi, 12, pp. 251–258, 2 figs., 1925.

Autumn endives [*Cichorium endivia*] in certain nurseries at Groningen (Holland) have been attacked by a disease which renders them completely unsaleable. The lower leaves show a wilting and light or dingy brown discoloration, from which only the midrib is exempt. Nearer the heart only the top part of the leaves shows these symptoms, while on both sides of the lower green portion are the dark brown uredosori of a rust. The base and roots of the plants remain healthy.

Some weeks after examining the diseased endives, the writer received some chicory plants from Sappemeer on which teleutospores had developed. Subsequently this stage was also observed on the endives at Groningen. There was no previous record of the occurrence of this stage in Holland. The teleutospores on both plants measured 21 by 32, 25 by 40, or 21 by 30 μ, but the spore stalks differed considerably in length, being only 48 μ on chicory and up to 76 μ on endive. This difference has been used as the basis for distinguishing two separate species *Puccinia cichorii* and *P. endiviae* (which are maintained by the writer), and it would appear from these observations that both occur in Holland. Cross-inoculation experiments are to be undertaken.

Measures advocated by Ritzema Bos to combat an epidemic of chicory rust in Friesland in 1900 included the application of Bordeaux mixture on the first appearance of the symptoms; removal of all diseased material; and use of nets or straw on the beds to prevent infection from neighbouring gardens.

GANDRUP (J.). **A Rhizoctonia disease of Vigna.**—*Trop. Agriculturist,* lxv, 6, pp. 362–368, 1925.

This is a translation of the paper which has already been noticed from the original Dutch [see this *Review*, iv, p. 564].

FAES (H.) & STAEHELIN (M.). **Les maladies cryptogamiques de la Vigne de 1922 à 1924.** [Fungous diseases of the Vine from 1922 to 1924.]—Reprinted from *Annuaire Agric. de la Suisse, 1925,* pp. 557–575, 1925. [Received February, 1926.]

The biology of downy mildew of the vine [*Plasmopara viticola*] is discussed with reference to the three most important factors in its development, namely, (*a*) the fungus; (*b*) atmospheric conditions;

and (c) the biology of the host. At a degree of relative humidity exceeding 80 per cent., such as prevailed in May and June 1924 [see next abstract], the stomata of the vine leaves remain constantly open, thus facilitating penetration by the germ-tubes of the fungus. In such years it is advisable to spray every ten to twelve days during the most active period of growth.

The results of comparative experiments carried on at the Lausanne Viticultural Experiment Station in the control of downy mildew are presented in tabular form. The following preparations were used: (1) ordinary 3 per cent. Bordeaux mixture; (2) the same with the addition of casein at the rate of 50 gm. per hectol.; (3), (4), and (5), 3 per cent. Bordeaux mixture with the addition of skim milk at the rate of 0·75, 1·5, and 2·25 l. per hectol., respectively; (4) Bex Burgundy mixture (containing copper and nickel sulphate) [see this *Review*, iv, p. 422] at the rate of 3 kg. per 100 l. of water; (7) a mixture of copper, nickel, zinc, and iron sulphates neutralized with milk of lime and used at the rate of 3 kg. per hectol.; (8) 'blue' Bordeaux mixture (Cadoret's brand) [see this *Review*, iii, p. 187; iv, p. 715]; (9) basic mixture of copper and nickel sulphate (1,500 and 1,000 gm. per 100 l. of water, respectively), neutralized with milk of lime; (10) Caffaro powder (oxychloride of copper) [see this *Review*, i, p. 66], 1 kg. per 100 l.; (11) nosperal, 1,000 gm. per 100 l.; (12) kurtakol, 500 gm. per 100 l.; (13) de Haën's colloidal copper, 500 gm. per 100 l.; and (14) colloidal copper prepared at the Viticultural Experiment Station.

All the treatments gave satisfactory results, especially Bordeaux mixture, with or without the addition of casein or skim milk. The best adhesion was given by the combined sulphates, the colloidal copper prepared at the Station, and Bordeaux mixture with 0·75 per cent. skim milk. The colloidal copper mixtures gave distinctly promising results and are stated to merit further investigation.

Good control of *Oidium* (*Uncinula necator*) was obtained in 1922 by two applications of ordinary sulphur, De Haën's colloidal sulphur, or 3 per cent. Bordeaux mixture with the addition of 125 gm. permanganate of potassium or 300 gm. hyposulphite of soda per hectol.

FAES (H.) & TONDUZ (P.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1924.** [Annual report for 1924 of the Federal Viticultural Experiment Station at Lausanne and Domaine de Pully.]—Reprinted from *Annuaire Agric. de la Suisse, 1925,* pp. 657–678, 1 graph, 1925. [Received February, 1926.]

This report contains the following references of phytopathological interest (pp. 658–664). The summer of 1924 was marked by an intensely severe outbreak of downy mildew of the vine [*Plasmopara viticola*], which was favoured by the high temperatures, heavy rainfall, and conspicuous lack of sunshine in May and June. These conditions promoted the precocious development of the vines, the susceptibility of which was increased by the succulence of the shoots. The first symptoms appeared on 10th June, and heavy losses occurred in the vineyards where the critical spray of 26th May (directions for which were previously published in the press)

was omitted. Successful results were obtained in experiments with various copper compounds for the control of the disease [see last abstract].

The changeable spring weather of 1924 promoted an abnormal extension of vine 'rougeot' [roter brenner: *Pseudopeziza tracheiphila*], which was, however, completely controlled by repeated applications of Bordeaux mixture, beginning when the shoots measured 5 to 10 cm. in length.

The pycnidia and spores of coître [livid rot of the vine or hail disease: *Coniothyrium diplodiella*: see this *Review*, iv, p. 140] have retained their viability for four years under laboratory conditions.

Apoplexy of the vine was present to a greater or less extent in the vicinity of Geneva. In some cases a Polyporaceous fungus [? *Fomes igniarius* or *Stereum hirsutum*: see this *Review*, iii, p. 630] was found to be associated with the disease. Winter applications of solutions with a base of arsenic salts gave good results in certain plots.

Further studies on the biology and control of the *Monilia* disease of apricots caused by *S[clerotinia] laxa* [see this *Review*, iii, p. 458] have confirmed the extremely dangerous character of the parasite under Valais conditions. Good results were given by the application, before the first sign of growth in the spring, of lime-sulphur 1 in 4, preceded by drastic pruning and excision of cankers. Great stress is laid on the importance of thoroughness and scrupulous care in the latter operations.

The cherry disease due to *Clasterosporium* [*Coryneum beijerinckii*: see this *Review*, iv, p. 98] caused heavy damage in the spring of 1924. The most striking feature of the attack was its suddenness, the foliage and fruit of apparently healthy trees turning brown and falling within a few days.

WORMALD (H.). **Notes on plant diseases in 1924.**—*Ann. Rept. East Malling Res. Stat., 1st January, 1924, to 31st December, 1924*, pp. 110–119, 1925. [Received March, 1926.]

The wet summer of 1924 was particularly favourable to the development of *Botrytis* spp., which caused some unusual types of disease, including a stem canker of apple trees (probably *B. cinerea*); a leaf spot of hops (provisionally referred to *B. cinerea*); a grey or whitish rot of onion leaves, probably caused by *B. parasitica*; a decay of onion bulbs thought to be due to the conidial stage of *Sclerotinia bulborum*; a brown rot of quinces (*B. cinerea*); and a foliage rot of 'soft wood' plum cuttings (*B. cinerea*). *S. cinerea* has also been found on two new hosts at the Research Station, namely, *Prunus pumila* (the flowers and young branches of which were killed) and whitebeam (*Pyrus aria*).

A disease of plum and cherry trees resembling that caused by *Diaporthe perniciosa* (which was, however, absent from the infected material) was prevalent in Kent and elsewhere (see this *Review*, iv, p. 39]. The margins of the lesions on the branches uniformly contained dense masses of bacteria which are believed to be involved in the causation of the disease.

A wilt of young plum shoots, sometimes accompanied by a die-

back of the main stem, and a shot hole condition of plum and cherry foliage, are also associated with the presence of bacteria, but they have not yet been definitely correlated with the die-back referred to above.

Leaf scorch of cherry trees (*Gnomonia erythrostoma* [see this *Review*, iv, p. 618] was general in 1923, especially on the Waterloo variety. The summer of 1924 was also very favourable to the development of the disease, which resisted all attempts at control by spraying with Bordeaux mixture or lime-sulphur, or by stripping off the dead leaves.

Small leaf of cherries [see this *Review*, iv, p. 39] is stated to be causing considerable losses in North Kent. In one orchard examined about three-quarters of the total area was affected, while the remaining portion showed no trace of the disease. This would appear to indicate that the trouble is due to unfavourable soil conditions.

In October 1923 *Armillaria mellea* was found on some old apple trees near East Malling [see this *Review*, iii, p. 258]. The fructifications at the base of the trees were shedding spores freely. About the same time the fungus was also observed on cob-nut trees [*Corylus*] in the same neighbourhood. In May 1924 rhizomorphs of *A. mellea* were found associated with a root disease of young pear trees in the Swanley district.

Roesleria hypogaea [see this *Review*, iii, p. 567] was observed in two places on the roots of young Reine des Poires pear trees, as well as on a damson and a plum tree at the Station.

Anthracnose of raspberries (*Plectodiscella veneta*) occurred both in the conidial and ascigerous stages in variety plots at the Station, this being believed to be the first record of the fungus in England.

Pseudopeziza ribis caused premature defoliation of currants and gooseberries, the latter being in one case seriously affected towards the end of June.

Marssonina juglandis, which is usually associated only with a leaf spot disease, was found on the fruit of walnut trees in a garden.

About 40 per cent. of the hills in a hop garden showed a wilting of the foliage and withering of the bines. A species of *Verticillium* was isolated from infected bines.

The so-called 'shab' disease of lavender, which has been investigated in Surrey, was found to be associated with the occurrence of *Phoma lavandulae* on the stems (*Kew Bull. Misc. Inform., 1916*, 5, p. 113) and of *Septoria lavandulae* on the leaves. The former was evidently the chief cause of the trouble, but the latter was responsible for considerable spotting and withering of the leaves. It seems highly probable that the disease is largely disseminated by propagation from infected bushes.

Pole Evans (I. B.). **Report No. IV. Botany and Plant Pathology.**—*Ann. Rept. Dept. of Agric., year ended 30th June, 1925, Journ. Dept. Agric. S. Africa*, xi, 6, pp. 571–576, 1925.

Besides information already noticed from other sources, the present report contains the following items of interest.

Dry rot of maize (*Diplodia zeae*) [see this *Review*, v, p. 99] is

stated to have been common in South Africa during the year under review. In view of the intention to intensify the culture of sugar beet in the Transvaal, special attention is called to the fact that a root rot caused by *Rhizoctonia* (*Corticium vagum* var. *solani*) was recorded in three localities where this crop was grown experimentally.

In consideration of the risk of introducing new diseases of sugar-cane in imported cuttings, the Department of Agriculture is prepared to agree to importation only on the condition that stringent quarantine measures are enforced. For this purpose the South African Sugar Association has built, at the Natal Herbarium, a quarantine greenhouse of the most modern type, in which imported setts will be grown for a year or more under the control of the Government Mycologist and Entomologist at Durban.

Evidence from studies in progress tends to show that the leaf spot fungus that often causes defoliation of lemon trees is identical with the *Alternaria* causing centre rot of navel oranges. A number of different strains of the organism are under investigation. Field studies of the concentric ring blotch disease of *Citrus* spp. show that the first spotting of the leaves develops on the second flush of growth about January; a bacterium was repeatedly isolated from affected leaves, but inoculation experiments with the organism failed to reproduce the disease. Ring blotch on the fruit is stated to have been common during the season under review.

During a visit to Sundays River Valley in August 1925, crown gall [*Bacterium tumefaciens*] was found in six of the ten deciduous fruit orchards inspected, and this is believed to represent the position throughout the country. In many cases the infection was traced back to nurserymen who supplied infected nursery stock. A series of experiments is now in progress at the Elsenburg School of Agriculture in connexion with the disinfection of stocks and of the soil; a search is also being made for varieties suitable for stocks which are resistant to crown gall.

In the Magaliesburg area a black rot of quinces, caused by a fungus as yet unidentified, was reported as causing considerable damage to the fruit. Artificial infection with pure cultures of the organism reproduced the disease in sound fruit.

Report of the Department of Agriculture, New South Wales, for the year ended 30th June, 1924.—34 pp., 1925. [Received 1926.]

The following references of phytopathological interest are contained in this report (chiefly in the biological section contributed by G. P. Darnell-Smith on pp. 22–23). Except for bunchy top of bananas [see this *Review*, i, p. 372], flag smut of wheat [*Urocystis tritici*], blue mould of tobacco [*Peronospora* sp.], which may be greatly reduced by the use of erect varieties with well-spaced foliage, and brown spot of mandarins [*Colletotrichum gloeosporioides*], the losses from plant diseases were not so heavy as in some previous years.

New records of disease included *Dothiorella mali* on apple, *Peronospora jaapiana* on rhubarb, and *Rhynchosporium secalis* on barley.

KIRBY (A. H.). **Control of plant pests and diseases.**—*Rept. Dept. Agric. Tanganyika Territory for the twelve months ending 31st March, 1925*, pp. 20–22, 1925. [Received March, 1926.]

This report contains the following references of interest other than those already noticed in this *Review*.

Wilt (*Fusarium* sp.) was found on an indigenous variety of *Hibiscus cannabinus* at Dar-es-Salaam.

On page 41 of this report it is stated that eleven varieties of Sudan sorghums [*Andropogon sorghum*] were destroyed by a serious attack of rust (*Puccinia purpurea*). Three sorghum smuts (*Ustilago reiliana* [*Sorosporium reilianum*], *Sphacelotheca sorghi*, and *S. cruenta*) were also reported during the year.

Report of the Chief of the Bureau of Plant Industry for the fiscal year ended June 30, 1925.—*U.S. Dept. of Agric., Bureau of Plant Industry, Washington, D.C.*, 36 pp., 1925.

This report contains the following references of phytopathological interest, other than those already noticed in this *Review* from different sources. As a result of the vigorous campaign conducted by the Gulf States in co-operation with the Bureau of Plant Industry, citrus canker [*Pseudomonas citri*] has been practically eliminated from the affected region [see this *Review*, iv, p. 412]. Mississippi is apparently free from the disease, no infection has been discovered in Alabama since June 1924, and there have been no new records from Texas during the year. Immediate measures were taken to eradicate the infected trees observed at Boynton, Florida, in March 1925. Scattered infections of nursery stock are still found in Louisiana, and during the year efforts have been concentrated on the Terrebonne and Lafourche properties. A reconnaissance inspection of the entire citrus area will be necessary for some years to come.

Considerable losses have been caused in the Potomac Valley by fireblight [*Bacillus amylovorus*] on the collars and roots of York Imperial, Ben Davis, and other apple varieties. Under bell jars or in damp chambers *B. amylovorus* has been proved capable of invading the tissues of mature winter apple fruits, and also of developing on the cut surfaces of rose cuttings.

An application of sulphur dust two or three weeks before picking in rainy seasons in Georgia has reduced the incidence of brown rot [*Sclerotinia cinerea*] on peaches in transit, but in drier weather this precaution is superfluous. Incipient brown rot infections and spores lodged in cuts or bruises can lead to rotting at 41° F., but surface spores seldom cause rot except at 48° or above, at least during ordinary shipping periods. The use of aeroplanes for dusting has given promising results.

The 'phoney' disease of peaches in Georgia has been increasing in extent and severity. The cause of the disturbance remains obscure, and all attempts at control have given negative results.

Shipping experiments showed that the growth of *Botrytis* on strawberries cannot be controlled by the best methods of refrigeration, and confirmed the observations of British workers that such rots may be arrested by small accumulations of carbon dioxide.

During the past six years a considerable reduction in the inci-

dence of virus diseases of potatoes has been effected by attention to the general principles of seed improvement. From 15 to 30 per cent. larger yields have been obtained from certified seed than from commercial stock.

Three new wilt [*Fusarium lycopersici*] resistant tomato varieties, the Marvana, Marvelosa, and Marglobe, were found superior to the Globe in resistance to nailhead rust [*Macrosporium* sp.] in variety tests in Florida and other Gulf States.

Experiments have shown that the cucumber aphis [*Aphis gossypii*], after feeding on a mosaic plant, can transmit the disease within five minutes to a healthy plant. In Wisconsin experiments on the control of cucumber mosaic by the destruction of wild hosts [see this *Review*, v, p. 142], only 12 per cent. of the cucumber plants showed infection on 1st September 1924 compared with 100 per cent. on 20th August for six seasons prior to the adoption of this method, while a control field showed 100 per cent. mosaic by 15th August.

It is estimated that of the annual cut of 22,000,000,000 cb. ft. of wood from United States forests, about 3,750,000,000 ft., representing an annual cost of $400,000,000, go to replace timber rendered valueless by fungus attacks. The value of sodium fluoride in the control of decay in wood pulp has been repeatedly proved [see this *Review*, iv, p. 645].

The common red heart fungus, *Trametes pini,* has been found much less destructive to the wood in its early stage of infection than organisms that cause the brown rot type of decay. Important relations between loss in specific gravity and loss in strength have been established in wood rotted by certain fungi, and it has been demonstrated that measurements of specific gravity are of no value in estimating strength properties in infected wood.

Division of Plant Pathology.—*Thirty-fifth Ann. Rept. Washington Agric. Exper. Stat. for the fiscal year ended June 30, 1925* (*Bull.* 196), pp. 32–36, 1925. [Received March, 1926.]

This report contains the following references of interest in addition to those already noticed. Tests were made of the comparative efficacy of various seed disinfectants in the control of bunt [*Tilletia tritici*] on artificially infected Jenkins' Club spring wheat. The average percentage of infection in the untreated plots was 11·39. Four treatments, viz., Roessler and Haslacher's copper carbonate (3 oz. per bushel), 30 minutes' immersion in 0·25 per cent. germisan, the same with U-11, and 10 minutes' immersion in formaldehyde 1 in 40, gave perfect control. Uspulun wa-wa dust, Mountain Copper Co.'s copper carbonate, super-kalimat, Bayer dust, and Dupont semesan were effective. Copper stearate, a preparation containing only 10 per cent. of metallic copper, reduced the incidence of infection to 1·15 per cent.

Attempts have been made to transmit the witches' broom disease of potatoes [see this *Review*, iv, p. 55] by grafting and by means of aphids. Positive results (which require further verification) have been obtained in the former case. Stock from witches' broom plants develops an abundance of spindling sprouts, bearing only a faint resemblance to normal potato plants.

One generation of giant hill Netted Gem and Burbank potatoes [see this *Review*, v, p. 179] has been grown in a field adjacent to healthy stock; all the progeny showed the typical giant hill character in the top, with characteristic spindle tubers.

The results of rigid selection against potato virus diseases by tuber indexing [see this *Review*, iv, p. 656] and field inspection of varieties were satisfactory with all varieties tested except Bliss Triumph. The progeny has been maintained relatively virus-free even in a locality where symptoms of these diseases are masked. It is suggested that Bliss Triumph should be replaced by Irish Cobbler in eastern Washington. It has been observed that in diseased stocks there is a tendency for all the eyes on a tuber to start growth at the same time, whereas on normal tubers those at the bud end ordinarily develop first.

Mosaic disease has been transmitted by aphids from tomato to potato and tomato in a limited number of cases under controlled conditions. Repeated tests have shown that *Solanum nigrum* and *Datura stramonium* do not transmit mosaic through the seed.

A study on the winter injury of fruit crops included field and laboratory investigations of *Stereum purpureum*, the spores of which were found to lose their viability in 24 hours under dry conditions, while retaining it for weeks in a humid atmosphere. The sporophores survived desiccation and produced repeated crops of spores following alternate drying and wetting. Viable spores were obtained from sporophores kept in the laboratory for a year. The optimum temperature for mycelial growth is apparently 25° to 27° C., but the fungus developed appreciably at 3° to 8°, indicating that some advance is made in infected trees during moderate winter weather. Preliminary pathogenicity studies show that *S. purpureum* progresses slowly in normal active trees, but rapidly in those weakened by winter injury or other factors.

Downy mildew of lucerne (*Peronospora trifoliorum*) was very severe on the first crop in the Yakima Valley. Powdery mildew of clover (*Erysiphe polygoni*) has been on the increase in both irrigated and non-irrigated fields in widely separated localities. Leak of potatoes (*Pythium de Baryanum*) appears to be spreading. Downy mildew of spinach (*P. spinaciae*) caused heavy infection on the early crop in the Walla Walla section.

Special studies were made of the canker of evergreen blackberries on Mount Vernon and the witches' broom of service berries (*Amelanchier*). *Coryneum ruborum* and an undetermined species of *Phomopsis* were found to be associated with the blackberry canker, the latter being apparently the causal organism. The witches' broom was found to be due to *Apiosporina collinsi*, which persists as a perennial mycelium in the buds and primary cortex of affected twigs.

The following diseases (new or little known in the State) have also been studied: black measles and water berries of the grape [see this *Review*, ii, p. 438]; black end of pears; seedling blight of cucumbers (possibly heat canker); mosaic and leaf curl of raspberries; hard rot of gladioli (*Septoria* spp.) [see this *Review*, v, p. 164]; sooty mould of plums (*Fumago*); apple scab (*Coniothecium* sp.); stem wilt of Shasta daisy [*Chrysanthemum maximum*], due

to *Sclerotinia sclerotiorum*; and anthracnose or leaf and twig blight of sycamore (*Gnomonia veneta*).

Twenty-fourth Annual Report of the Bureau of Agriculture, Philippine Islands, for the fiscal year ending December 31, 1924.—284 pp., 29 pl., 1 chart, 1925.

In the section dealing with plant diseases, pp. 167–196 of this report, the following items are of interest.

A serious outbreak of a wilt disease causing considerable damage to tobacco plantations was recorded in March 1924, in the towns of Agoo and Tubao, La Union. Isolations from diseased material showed the constant association with the condition of a fungus that was identified by subsequent cultural studies as *Fusarium oxysporum*, and also, but only occasionally, the presence of another organism, believed to be *Bacterium solanacearum*. Successful inoculation experiments with *F. oxysporum*, with subsequent re-isolation of the organism, together with its constant presence in the diseased plants, indicate that it is capable of causing tobacco wilt.

Colletotrichum gloeosporioides caused in 1924 a severe flower blight of mango trees [*Mangifera indica*]; this fungus is stated to attack the flowers, fruits, stems, and leaves of the mango in Florida, Hawaii, and Porto Rico, but though it had been reported on citrus, it had not previously been seen on the mango in the Philippines.

Citrus trees at Lamao were affected by the following diseases, listed in the order of their severity: bark rot [see this *Review*, iii, p. 332], pink disease [*Corticium salmonicolor*], canker [*Pseudomonas citri*], foot rot [? *Phytophthora parasitica*], and mottled leaf [see this *Review*, ii, p. 108]. The first attacked all species of citrus except *C. micrantha*, and a total of 27 trees died from this disease in the Lamao Experimental Station during 1924. Experiments at the Tananan and Lamao Stations confirmed that, in its early stages of infection, bark rot is amenable to treatment with carbolineum, but that severely attacked trees cannot be saved by any known means.

As a result of the campaign against coco-nut bud rot [*Phytophthora palmivora*], over 3½ million trees were inspected during the year in the provinces of Laguna, Tayabas, and Cavite. Of these, 6,637 trees were found to be infected, and 6,354 were cut down and burnt.

Tucker (C. M.). **Report of the Plant Pathologist.**—*Rept. Porto Rico Agric. Exper. Stat. 1924*, pp. 26–29, 3 figs., 1926.

A survey of the western coast of Porto Rico, from Mayaguez to Rincon, in September 1923, revealed some 700 cases of bud rot of coco-nuts [see this *Review*, v, p. 164], the symptoms of which are briefly described. In February 1924, a species of *Phytophthora* was isolated from a palm in the earliest observable stage of the disease, and inoculated into healthy trees with positive results. The average length of the conidia was 50·4 μ and their diameter 30·23 μ, while the chlamydospores measured 32·96 μ, thus agreeing more closely with *P. palmivora* than with *P. faberi* [see this

Review, iv, p. 414]. Forty-two diseased palms were destroyed in the Peña Cortada district of Mayaguez in November 1924, and within the next six months six new cases occurred, each within 30 ft. of the spot occupied by one of the original infected trees. The freshly diseased individuals were destroyed, and no new cases of infection were observed four months later.

A species of *Fusarium* has repeatedly been isolated from diseased vanilla roots. Ten out of twenty pots filled with soil from a plantation infested two years before were autoclaved, and all were planted with vanilla cuttings. Those in the sterilized soil made good growth, while the roots of those in the control plots were killed as soon as they began to develop. Experiments in the inoculation of cuttings growing in coco-nut fibre with a cornmeal culture of the fungus resulted in 50 per cent. of infection. Normally, the disease appears in plantings about the fourth year, the accumulating acid from decaying organic matter probably creating favourable conditions for development. Growers have been advised to burn infected plants *in situ* to prevent possible dissemination of the spores from the aerial roots.

Morphological studies of 35 leaf-spotting fungi (*Cercospora* and *Helminthosporium* spp.) are in progress.

A planting of Chamaluco bananas, selected for resistance to wilt (*Fusarium cubense*) failed to produce fruit in 1924, and notwithstanding the application of lime and fertilizers, they succumbed to the disease before blossoming. This variety will be replaced by others giving greater promise of resistance.

LEVINE (M.). **The effects of radium emanation on the crown gall tissue.**—*Amer. Journ. of Roentgenology and Radium Therapy*, xiv, 3, pp. 221–233, 4 pl., 1925.

The effect of introducing glass capillaries containing radium emanation [see this *Review*, ii, p. 493] into young and old crown galls, chiefly on young growing geranium stems and petioles, has been further studied by the author.

When the tubes were introduced 24 to 48 hours after inoculation, galls failed to develop. The stem in the vicinity of the irradiation turned black and was apparently killed, while the cells nearest the capillary were destroyed.

On galls 14 to 30 days old and of appreciable size, an exposure of three hours killed the cells next to the capillary, while those further out appeared to be normal. Longer exposure (15 to 48 hours) caused collapse and death of a band of cells, extending from four to nine layers in the latter case, while individual cells further out were necrotized and the rest were apparently normal. Still longer exposures (up to 18 days) with small doses of radium had similar effects. Larger doses for short periods increased the thickness of the necrotic zone to one to three mm., and many of the cells further out were affected. Exposure to relatively small doses for long periods may cause the gall to regress and die, but this is not considered to be entirely the result of the irradiation but to be in part the result of the normal end of the life of the gall. Even when growth continues in the control galls beyond the period at which those exposed to irradiation are dead, the author does not

admit that death is directly due to the irradiation, but regards it as a secondary result of the induced necrosis. When only one side of an actively growing old gall is irradiated, that side may be killed while the rest continues to grow. In one case of the kind described the whole gall died 53 days after exposure, but the irradiated part was quite different in appearance from the rest, and the latter was not thought to have been killed by the rays. The stem on which it grew was unaffected by the treatment. Furthermore, galls thus apparently killed may renew growth from the margins some months later.

WALKER (W. A.) & THOMPSON (N. F.). **Black stem rust and the progress of Barberry eradication in Wisconsin.**—*Wisconsin Dept. of Agric. Bull.* 68, 24 pp., 8 figs., 1925.

This is a popular account of the campaign for the eradication of the common barberry (*Berberis vulgaris*) in Wisconsin, with a view to reducing the incidence of the black stem rust of wheat, oats, barley, and rye [*Puccinia graminis*], the life-history of which is outlined. It is stated that the first spring infections in the State have always been found near barberry bushes. The first survey and eradication of all bushes found was completed in 1924; and a second survey, now in progress, has revealed a number that had previously escaped detection. About 3,300,000 bushes were found, in addition to seedlings and sprouts. The cost is stated to have been less than three cents. per acre of small grains grown in a single year. Subsequent intermittent inspections to detect seedlings will be necessary for some time, as the seed may remain ungerminated in the soil for at least four years.

CLAYTON (E. S.). **A common source of infection with flag smut.**—*Agric. Gaz. New South Wales*, xxxvi, 12, p. 860, 1925.

The alarming rate at which flag smut of wheat [*Urocystis tritici*] has been spreading of recent years in New South Wales is attributed by the author to a great extent to the prevailing habit among the local farmers of feeding horses on chaff made from wheaten hay infected with the disease, as the spores of the causal fungus pass through the alimentary canal of animals without losing their germinative power. Where flag smut is prevalent wheat chaff should be replaced by oaten chaff in the horses' diet.

TAMM (E.) & HUSFELD (B.). **Die elektrische Heisswasserbeize, ein neuer Weg zur technischen Durchführung des Heisswasserverfahrens.** [The electrical hot water steeping apparatus, a new method for the technical execution of the hot water treatment.]—*Pflanzenbau*, ii, 13, pp. 197–202; 14, pp. 213–220, 1926.

This is a more detailed account of the electrical hot water seed-steeping apparatus than that already noticed from another source [see this *Review*, iv, p. 660]. Very promising results are stated to have been obtained with this method in the control of blossom infections, e.g., loose smut of wheat, oats, and barley [*Ustilago tritici*, *U. avenae*, and *U. nuda*], as well as of seedling infection of barley by covered smut (*U. hordei*). Among other advantages

claimed for this apparatus (which is supplied by Maschinenfabrik F. Neuhaus, Eberswalde, Ackerstr. 5–6) are economy, uniform heating of the steeping liquid and of the seed-grain, and ready maintenance of an even temperature.

KLAGES (A.). **Ueber die Bekämpfung von Getreidekrankheiten durch chemische Mittel.** [The control of cereal diseases by chemical methods.]—*Zeitschr. Angew. Chemie*, xxxix, 1, pp. 3–10, 1926.

This is a full account of the paper on the chemical control of cereal diseases read at the General Meeting of the German Chemists' Union in September 1925, and which has been already noticed [see this *Review*, v, p. 85].

URBÁNYI (E. v.). **Beizversuche mittels des Desinfektionsmittels 'Salan'.** [Steeping experiments with the disinfectant 'salan'.] —*Zeitschr. für Pflanzenkrankh.*, xxxv, 7–8, pp. 290–296, 1925.

Experiments were conducted at the Phytopathological Institute of Budapest University in the control of bunt of wheat (*Tilletia tritici* and *T. levis*) by a new disinfectant, known as salan, which is stated to have given excellent results in dairy work and agriculture.

Salan is the sodium chloride solution of glycerine, formaldehyde, and a mixture arising from the action of an organic catalyzer. It is a clear, transparent liquid with a smell of formaldehyde and a saline taste, non-inflammable, and miscible with water without becoming cloudy.

The tests were carried out with seed of No. 1211 Hatvan selected autumn wheat on the lines of Gassner's chemotherapeutical experiments [see this *Review*, ii, pp. 554–557; iv, p. 231]. The best results were given by one hour's immersion in a 1·5 per cent. solution of salan, which completely inhibited the germination of the spores without any serious reduction of that of the seed. There is no danger of over-steeping, as with formaldehyde, since even at concentrations of 2 or 3 per cent. the reduction of germination is negligible.

QUODLING (H. C.). **Pickling Wheat with carbonate of copper.**—*Queensland Agric. Journ.*, xxiv, 5, pp. 456–457, 1 diag., 1925.

Brief directions are given for the control of bunt of wheat [*Tilletia tritici* and *T. levis*] with copper carbonate at the rate of $\frac{3}{4}$ oz. per bushel of grain. The construction of a simple appliance for disinfection operations is described, and the principal advantages of dusting over the liquid treatment are enumerated.

Bunt and smut—the use of carbonate of copper.—*Queensland Agric. Journ.*, xxiv, 6, p. 633, 1925.

Tests were carried out in 1925 at the Roma State Farm by the Queensland Department of Agriculture to determine the efficacy of copper carbonate in the control of bunt of wheat [*Tilletia tritici* and *T. levis*]. Absolute control was given by this preparation used at the rate of $1\frac{1}{2}$ or 2 oz. per bushel, compared with 87 per cent. infection in the untreated plot and 2 per cent. in that dusted with only 1 oz. copper carbonate per bushel.

RICHARDSON (W. T.). **The use of dry pickled Wheat for poultry.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., ii, 4, p. 477, 1925.

Experiments in which two fowls were fed for about a fortnight on wheat treated with copper carbonate dust at twice the strength used in practice for the control of bunt [*Tilletia tritici* and *T. levis*], showed that this diet had no detrimental effect on the general health of the fowls tested. On post-mortem examination their internal organs were found to be in a practically normal condition.

HYNES (H. J.). **On the occurrence in New South Wales of Gibberella saubinetii, the organism causing scab of Wheat and other cereals.**—*Journ. and Proc. Roy. Soc. New South Wales*, lvii, pp. 337–348, 5 pl., 1924.

Oat stubble collected in January 1922, at the Grafton Experiment Farm, New South Wales, exhibited a foot rot condition, in which the main roots of some of the plants were covered with a thin, whitish mycelial weft, bearing numerous perithecia. From a careful study of the morphological characters of the causal fungus, the author concludes that the organism is *Gibberella saubinetii*, although the local strain exhibited certain marked cultural differences [shown in tabular form] on potato dextrose agar and potato mush agar, when compared with a pure culture of the fungus obtained from Wisconsin, United States.

Greenhouse infection experiments with the local strain indicated that, under favourable conditions, it is pathogenic on heads of Federation wheat, and is also capable of causing seedling blight in Federation and Hard Federation wheat, Algerian oats, Cape barley, and Black Winter rye.

CHRISTENSEN (J. J.). **Physiologic specialization and mutation in Helminthosporium sativum.**—*Phytopath.*, xv, 12, pp. 785–795, 4 figs., 1925.

The writer has made a detailed study of 37 strains of *Helminthosporium sativum*, which can be distinguished by cultural characters.

Tests were made of the comparative virulence of the forms by inoculating the soil of four pots, each containing 25 seeds, with pure cultures. Both Marquis (C. I. 3641) and Mindum (Minn. No. 470) wheat were more or less susceptible to the 26 forms of *H. sativum* used, but distinct and consistent variations were observed in the virulence of different forms on both varieties. Forms 3, 19, 21, and 26 were relatively weak.

Similar differences were noticed in the case of barley, which was inoculated with all 37 forms. Of the four most virulent forms, namely 5, 11, 34, and 37, the two first were virulent on wheat also. Forms 3, 4, 30, and others were only weakly parasitic, and these, in general, were also weak pathogens on wheat.

Comparative cultural tests extending over several years have largely corroborated the results obtained by Stevens [see this *Review*, ii, p. 59] with regard to mutations in *Helminthosporium*. A study of successive transfers from variant sectors indicated that the changes were genotypic and not mere modifications due to

environmental conditions. Mutants bred true whether propagated from spores or mycelium [see also this *Review*, iv, p. 421]. Some forms were found to mutate more often than others, while a given form was also observed to mutate more frequently on certain media. On potato dextrose agar 18 out of the 37 forms developed mutations, while sectors occurred in 27 forms grown on the oatmeal-rice-cornmeal agar. Seven forms failed to mutate on either medium. Some of the mutants mutated still further in culture. Colonies of a mutant have been observed to produce distinct sectors which in turn mutated while still in the same plate. Two mutants gave rise constantly to new mutants, their action suggesting genetic contamination. The mutants differed culturally from each other quite as much as do certain species, e.g., *H. teres*, *H. pedicellatum*, and *H. gramineum*.

In order to determine possible differences in the degree of virulence of mutants and their parents, comparative tests were made on Trebi barley and Marquis wheat. Most of the 13 mutants resembled the parent form in this respect, but two (especially No. 40) were decidedly more virulent, while three were less so.

JOHNSON (T.). **Studies on the pathogenicity and physiology of Helminthosporium gramineum Rab.**—*Phytopath.*, xv, 12, pp. 797–804, 1925.

An investigation was undertaken at the Minnesota Agricultural Experiment Station into some important factors in connexion with stripe disease of barley (*Helminthosporium gramineum*).

Early sown barley is usually more liable to infection than that sown late, and experiments were therefore conducted to ascertain whether any correlation existed between temperature during germination and early growth and the incidence of the disease. Naturally infected seed was planted in pots at soil temperatures of 18° to 20°, 23°, 27°, and 32° C., eight pots, each with 20 kernels, at each temperature. Four pots were also kept at 10° to 12°. On removal from the controlled temperature tanks all the pots were placed in a moderately cool place. Stripe first appeared on 31st January, one month after sowing, in the plants kept at 10° to 12°, which were considerably smaller than those held at the higher temperatures. The incidence of infection was 12 per cent. at 10° to 12°, 4·3 per cent. at 18° to 20°, and 0·62 per cent. at each of the other temperatures.

These results show that low temperatures favour infection, the critical period for which is during, and immediately after, seed germination. Hence the comparative immunity of barley in warm regions and the severity of the disease in the cooler climates are readily explicable.

Tests were carried out to determine how far *H. gramineum* could infect germinating seed of the susceptible Minsturdi variety. Ordinary and dehulled seed was steeped in hot water (15 minutes at 52° or two hours at 46° to 48°) prior to inoculation, during germination, with the spores or mycelium of the fungus, and then sown in pots held at 18° to 20°. The first symptoms of stripe appeared three weeks after planting, the highest incidence (23·5 per cent.) occurring on dehulled seed inoculated with mycelium. It

was evident that the period of maximum susceptibility was before the emergence of the coleoptiles from the glumes [see this *Review*, iii, p. 513].

In a second test all the seeds were dehulled, soaked in water at 52° for 15 minutes, inoculated with spores or mycelium, and kept at 16° and 22°. The first infection appeared nine days after sowing, the incidence amounting to 97·7 per cent. at 16° and 90·9 per cent. at 22°.

On germinating seeds, treated as above but without removing the hulls, the incidence of infection amounted to 32·7 per cent. in the seed soaked at 46° to 48° for two hours, and to 66·9 in that immersed at 52° for 15 minutes.

As in the former tests, inoculations with the mycelium resulted in heavier infection than that with the spores.

The fact that the disease can be produced by inoculating germinating seed from which the glumes have not been removed indicates that infection may occur through the coleoptile, as the embryo is naturally protected in such seeds.

A considerable number of monospore isolations were made from material collected in Minnesota, Colorado, Saskatchewan, and Alberta. All except one of the cultures from these strains resumed normal growth on removal to room temperatures after ten to twelve days at 32° to 33° C. The strain which succumbed to the high temperatures originated at Edmonton, Alberta. It was morphologically indistinguishable from the other strains and produced the typical symptoms of the disease when inoculated into dehulled barley seed. This strain, however, grew slightly better at 5° to 6° than the others, and the difference in its temperature relations indicates that it is a distinct physiological form.

All attempts to induce the production of conidia on artificial media gave negative results. The maximum hydrogen-ion concentration at which growth was obtained was P_H 2·52; the limits of hydroxyl-ion concentration lie beyond 9·25. The maximum and minimum nutrient concentrations for growth on a number of sugar solutions were found to be M/1 and M/1,000, the optimum being M/10 to M/100.

GAINES (E. F.). **Resistance to covered smut in varieties and hybrids of Oats.**—*Journ. Amer. Soc. Agron.*, xvii, 12, pp. 775–789, 1 graph, 1925.

During the years 1918 to 1925, over 200 varieties and selections of oats have been tested at Pullman, Washington, for resistance to covered smut (*Ustilago levis*) [see also this *Review*, iv, p. 661].

Each test consisted of a rod row containing 40 to 70 plants, except in 1918 when the rows were four rods in length. The seeds were uniformly blackened with smut spores before sowing. At harvest time the plants were divided into three classes, viz., smut free, partly smutted, and entirely smutted. Seventeen varieties were tested for one year, 91 for two, 67 for three, and 35 for four or more years. The minimum period in which relative susceptibility can be definitely established was found to be three years.

The results of the experiments are presented in tabular form and

briefly discussed in the text. For the most part, the immune and resistant classes belong to the Burt and Red Rustproof groups. The more resistant classes are usually of the Kherson or Sixty Day type, while the hull-less and common groups are generally susceptible, the outstanding exceptions being the three Markton selections [see this *Review*, iv, p. 87] and the four Red Rustproof-Black Tartarian hybrids, which are immune.

Red Rustproof (*Avena byzantina*), which has been immune in all the tests even when the hull is removed, is considered genetically immune. It has been crossed on several susceptible varieties of cultivated oats and the F_3 generations of four of these crosses (comprising over 800 families), and over 100 F_4 selections, were tested for resistance on the lines described above. The average incidence of smut in the four susceptible parents in 1918 to 1920 was as follows: Black Tartarian (*A. sativa orientalis*), 32 per cent.; Abundance (*A. sativa*), 22 per cent.; Large and Chinese Hull-less (*A. nuda*), 90 and 87 per cent., respectively. As was to be expected from the great susceptibility of the hull-less varieties, the number of immune families in the F_3 generation of the crosses of these with Red Rustproof was very much smaller than that of Red Rustproof with Abundance (41·5 compared with 82·5 per cent.). In all four crosses, however, there were a large number of immune segregates. One segregate of the hull-less type was immune in all the tests through the F_3, F_4, and F_5 generations. The results are considered to show that there are three dominant, independent factors in hulled crosses, any one of which prevents the occurrence of covered smut. In the case of the hull-less crosses, complete dominance can only be assumed for two of the factors, the third being intermediate for resistance. There is no clear correlation between smut resistance and hull-lessness, red glumes, awns, lemma base and colour, or date of heading.

Of 56 F_3 plants selected from smut-free rows, 45 produced only healthy plants in the F_4 generation.

ROUSSAKOV (L. F.). К вопросу о выпревании озимей. [On the problem of winter injury to autumn-sown cereals.]—*La Défense des Plantes*, Leningrad, ii, 6, pp. 349–355, 1925. [Received March, 1926.]

The present paper is an attempt to throw some light on the still obscure problem of the so-called winter injury to autumn-sown cereals, usually attributed to *Fusarium nivale* [*Calonectria graminicola*], by the comparative study of the meteorological factors that prevailed during the very long and severe winter of 1923–24 in two localities in which the crops suffered from the trouble to a widely different degree, namely, at the Agricultural Experiment Station of Vinnitza (Government of Podolia, Ukraine) and the neighbouring country, where in the spring of 1924, from 85 to 90 per cent. of the plants were found to have been killed, and at the Seed Selection Station of the Sakharotrust [Sugar Trust] of Nemertchi some 40 to 50 miles distant from the first, where the damage done did not exceed 2 to 3 per cent.

In spite of their comparative proximity, weather conditions differed considerably at the two points, both during the preceding

autumn and the winter. From September to December 1923 the rainfall at Vinnitza was more than three times as heavy as that in Nemertchi, which, together with a higher temperature (sometimes by as much as 6° C.), promoted an early luxuriant growth of the cereals in Vinnitza, as compared with a delayed start of some 25 days and poor autumnal growth at Nemertchi.

During the two weeks preceding the first heavy snowfall the mean air temperature at Vinnitza was + 2·7° C., so that the soil remained unfrozen under the snow cover, while at Nemertchi the mean temperature was − 0·2° C. Ten days after the snowfall, which at Vinnitza was varied by occasional rain, the snow cover in that locality was never less than 20 cm. deep and was sufficient to protect the soil from the effect of the then prevailing low air temperatures, so that the plants under it could continue their vital functions. At Nemertchi on the other hand, there was practically no snow, and air temperature kept at 7° to 14° C. below zero.

On the ground of these meteorological data, the author considers that the high mortality of the cereals at Vinnitza was primarily caused by the relatively high air temperature and heavy rainfall during the autumn, and the loose (unfrozen) condition of the soil at the moment when the first snow fell, so that at no time was a state of anabiosis attained by the plants. The immediate cause was the asphyxiation of the plants that were isolated by the snow cover from the atmospheric oxygen while their vital functions were not suspended by frost. It was further noticed that in places where the snow cover was less deep (on higher ground) and melted a few days earlier in the spring, the percentage of mortality was much lower, namely, from 30 to 60. The inference is, therefore, that the establishment of *Fusarium nivale* was facilitated chiefly by a lowering of vitality of the host, due to lack of oxygen, although the fungus was also observed to kill quite healthy plants.

Another interesting observation was the bearing of the winter injury on the subsequent development of rusts (*Puccinia dispersa*, *P. triticina*, and *P. glumarum*). In places where the rye emerged uninjured from the snow cover, its leaves were found to bear fresh pustules of *P. dispersa* with spores that germinated readily. This establishes the hitherto unrecorded overwintering in Russia of this rust through the uredospores. In places where the snow thawed two or three days later and where almost all the leaves of the cereals were attacked by the snow mould, rust sori could be found only with considerable difficulty, while where the winter injury was highest, there was no trace of the rust. This would indicate that outbreaks of the snow mould may have a controlling effect on the rusts by killing the infection foci during the winter.

Schaffnit [E.]. **Zur Behandlung von Saatgut mit Reizchemikalien.** [Note on seed treatment with chemical stimulants.]—Reprinted from *Mitt. Deutsch. Landw. Gesellsch.* [xl], 42, 2 pp. 1925.

In connexion with a series of experiments which are in progress at Bonn on the stimulation of germination by chemical treatment, the writer briefly describes the remarkable results obtained on another occasion with rye seed-grain heavily infected with *Fusarium*

[*Calonectria graminicola*]. The plants from diseased seed treated with chemical stimulants (especially uspulun) showed a marked superiority, during the entire period of growth, over those from healthy seed similarly treated. This phenomenon must be ascribed to the fungicidal effect of the preparations, since no stimulus to the development of the healthy seed was apparent. Possibly the favourable results secured by the use of certain chemical preparations should be attributed to their fungicidal properties rather than to any definite stimulatory effect.

McDonald (J.). **Diseases of Maize and notes on a parasitic Maize weed in Kenya.**—*Kenya Dept. of Agric. Bull.* 4, 6 pp., 1 pl. [Received February, 1926.]

Brief notes are given on the symptoms and control of the following diseases of maize, none of which has so far caused very extensive damage in Kenya. Ear rot (*Gibberella saubinetii*) [see this *Review*, v, p. 17] affects only the ears, sheaths, shanks, and possibly the stalks, the destructive foot rot and seedling blight occurring in the United States not having been reported as yet [see this *Review*, iii, p. 702]. It has occasionally caused losses up to 15 or 20 per cent. of the crop.

Head smut (*Ustilago reiliana*) [*Sorosporium reilianum*], which has only recently been reported from Kenya, is almost entirely confined to the tassels and ears.

Leaf blight (*Helminthosporium turcicum*) [see this *Review*, v, p. 18] is probably co-extensive with the maize area in Kenya, but so far it has not been of serious importance. In addition to the Natal White Horse Tooth, the Hickory King and Potchefstroom varieties appear highly resistant.

Rust (*Puccinia sorghi*) causes very little damage.

A brief description is given of the characters and life-history of the parasitic weed *Striga hermonthica*, which is stated to be closely related to *S. lutea* [see this *Review*, i, p. 425].

Deckenbach (K. N.). Новый паразит головневых. [A new parasite of smut fungi.]—*La Défense des Plantes*, Leningrad, ii, 3, pp. 162–165, 1 fig., 1925. [Received March, 1926.]

In the present note is recorded the finding by the author of *Oospora verticillioides* Sacc. parasitizing immature sori of *Ustilago maydis* [locality not indicated, but presumably in the experimental garden of the Plant Protection Station in Leningrad]. The sori attacked were stunted, and failed to reach complete development; their surface, at the points attacked, was wrinkled, and bore a mealy efflorescence consisting of the mycelium and conidia of *O. verticillioides*, contrasting by its faint pinkish, dull colour, with the bright, glassy surface of the rest of the sorus. The points of infection varied with the location of the sori: on those developing from the ovaries of maize, the parasite was usually found on the apical portion, while on sori growing in the axils of the leaves, it generally developed at the base.

Oospora verticillioides usually occurs on living parts of maize,

namely, on the leaves sheathing the ears, and more particularly in the ovaries at different stages of development and in the mature grain. Out of 20 fully developed maize ears examined by the author, four were found to be infected by the fungus, but in his experience, stunted ears almost invariably revealed the presence of the organism which formed over the surface of the grains a dense weft, the thickness of a leaf of blotting-paper, composed of the residue of the pistils interwoven with fungal hyphae. In still more stunted ears, not over 5 cm. in length, the fungus was also found inside the ovaries, which then exhibited a brownish discoloration. Artificial infection of immature maize ears with *O. verticillioides* invariably gave positive results, the organism being subsequently recovered without any secondary contamination.

In the author's opinion, his observations establish unquestionably the fact that *O. verticillioides* is a parasite both of maize and of *Ustilago maydis*, which throws a new light on its systematic position. He inclines to the view that it is the conidial form of some higher fungus, probably belonging to the Hypocreales, namely Hypomyceteae, to which it is most closely related by its morphology. He bases his view on some considerations which he proposes to develop in a further paper, and on the fact that in 1922 he found, although in an immature condition, well-defined chlamydospores on the mycelium of *O. verticillioides* growing between a leaf and the stem of a maize plant, and also inside a maize stem. The chlamydospores were either intercalary or (more rarely) produced at the apex of hyphae; they were smooth, hyaline, joined in groups of two to three, and, in their general features, resembled the chlamydospores of Hypocreales such as *Hypocrea rufa*.

DRECHSLER (C.). **Leafspot of Maize caused by Ophiobolus heterostrophus n. sp., the ascigerous stage of a Helminthosporium exhibiting bipolar germination.**—*Journ. Agric. Res.*, xxxi, 8, pp. 701–726, 2 pl., 5 figs., 1925. [Received February, 1926.]

This is a detailed account of the leaf spot of maize from Florida and the Philippine Islands briefly described by the author in an earlier communication [see this *Review*, iv, p. 411] as distinct from maize leaf blight, *Helminthosporium turcicum*. Besides occurring on maize, the disease has also been found, causing similar symptoms, on the leaves of teosinte (*Euchlaena mexicana*) in the Philippines.

On both hosts, the leaf spot disease is characterized by numerous (from 200 to 300 on one single leaf) cinnamon-buff or purplish lesions, surrounded by a darker reddish-brown margin, and often delicately variegated with brownish, zonate bands. The spots are at first elliptical, later long-rectangular, typically limited to a single intervenous space, usually 1 to 3 by 5 to 15 mm., and frequently coalescing to form more extensive lesions. From stomata in the centre of the dead spots arise, either singly or in groups of two or three, olivaceous, widely septate conidiophores, from 4·5 to 7 μ broad, and 120 to 170 μ long in nature, but under moist conditions developing in the form of irregularly branched, fertile hyphae often over 1 mm. in length. The conidia developed at 25° C. on maize leaves in damp chambers or in pure cultures are fuliginous to light

olivaceous, from 30 to 115 by 10 to 17 μ in diameter, often strongly curved, usually widest near the middle and tapering towards the rounded ends, and with up to 12 septa. The peripheral wall is thin, especially in the apical and basal portions, and the basal scar is broad and generally protruding. The conidia germinate readily in water by germ-tubes from both poles.

Diseased maize leaves incubated in a damp chamber developed perithecia in the neighbourhood of the conidiophores. These were apparently subepidermal at the initial stages, but soon broke through the epidermis. They are black, often bearing on the outside a variable number of conidiophores, but without differentiated sterile setae. The ascigerous portion is somewhat ellipsoidal or sub-globose, usually from 0·4 to 0·6 mm. in transverse and about 0·4 mm. in vertical diameter, with a well-defined, ostiolate beak, and consisting, in the interior, of colourless, pseudoparenchymatous tissue, composed of vertically appressed filaments, which diminish with the development of the asci. The latter are numerous, short stipitate, with rounded apex, sub-cylindrical, 160 to 180 by 24 to 28 μ, and contain 1 to 4 (typically 4) filamentous, fuliginous ascospores, 130 to 340 by 6 to 7 μ in diameter, coiled in a close heterostrophic helix with about four turns to each spore. Later the spores become five to nine times septate, with perceptible constrictions at the septa. The ascospores germinate freely by producing up to eight germ-tubes, from 3·5 to 5 μ in diameter, from any or all the cells, either laterally or terminally.

Inoculation experiments showed that the fungus is a vigorous parasite on maize, but only produces incipient infections on rice and sugar-cane.

The author discusses at length the systematic position of the fungus, the perithecial stage of which, so far as he is aware, has not been described before. He refers it tentatively to the genus *Ophiobolus*, although it is not obviously closely related to other species of this genus parasitic on grasses, and suggests for it the name *O. heterostrophus*.

From a brief review of the literature on maize leaf blight the author believes that the leaf spot disease is probably widely distributed, outside Florida and the Philippines, in all tropical and sub-tropical maize-producing regions, having been apparently often confused with the leaf blight caused by *H. turcicum*. In the latter the spots are few on each leaf and up to a hundred times the size of those caused by *O. heterostrophus*. In leaf blight the spots are not zoned, and spread is not sharply limited by the veins. Morphologically, the two fungi are readily distinguished, the strong curvature, greater septation, lesser length and especially breadth, and characters of the basal scar being important in recognizing the conidia of the leaf spot fungus. Both diseases co-exist in the Philippines and probably in India. *H. curvulum* Sacc., as distributed from the Philippines on maize tassels, is quite distinct from either of the two forms mentioned above, having small, 3- or 4-septate, bent conidia, the end cells lighter in colour, and tapering sharply from the broad central cell to the ends. A fungus closely resembling *O. heterostrophus* has, however, been found on tassels in conjunction with *H. curvulum* from the Philippines.

WORONICHIN (N. N.). О новом для Закавказья вредителе Кукурузы, **Phaeostagonosporopsis zeae (Schw.) Woronich.** [*Phaeostagonosporopsis zeae* (Schw.) Woronich., a new parasite of Maize in Transcaucasia.]—*La Défense des Plantes*, Leningrad, ii, 6, pp. 331–334, 1925. [Received March, 1926.]

The author records the discovery in Georgia, Transcaucasia, of a maize disease, characterized by the presence, especially towards the base of the ears, of a dense white mycelial weft, filling the spaces between the grains. Some of the latter were wrinkled, and bore numerous minute black pycnidia on the walls in contact with other grains. The pycnidia measured, when round, up to 465 μ and, when oval, 280 to 396 by 156 to 312 μ in diameter, and were developed chiefly between the cortex and the aleurone layer or in the outer part of the endosperm. Some were found in the outer tissues of the axis of the embryo, where they were at times so densely aggregated as to appear like cavities in a stroma.

The pycnidial walls are intermediate in type between the pseudopycnidia of Potebnia (*Ann. Mycol.*, viii, p. 65, 1910) and the conceptacles of *Phomopsis*. They consist of densely interwoven hyphae, becoming indistinctly pseudoparenchymatous only at the periphery. The hymenium consists of a layer of hyaline, baculiform conidiophores, 10 by 1·5 μ, from the apex of which are abstricted the conidia. The latter are cylindrico-fusiform, rounded at the apex and somewhat tapering at the base, curved or bent or occasionally sigmoid, light brown, and 16·5 to 30 or more by 5 to 6 μ in diameter. Ordinarily they are uniseptate, but occasional spores have two or three septa, without constriction. One of the septa is always medial.

The mycelium penetrates the endosperm as fine hyphae which dissolve the starch grains. It is also found in the cortex and pith of the rachis, where the hyphae are not more than 1·6 μ broad as a rule, though between the grains they may be 3 μ in diameter. Affected grains lose germinability.

The author has no doubt that this fungus is the same as that known as *Diplodia zeae*, but he points out that it cannot be referred to *Diplodia* owing to its pycnidial characters. The presence of pluriseptate spores suggests *Hendersonia*, but here again the pycnidial characters are incorrect. The fungus, in fact, stands in the same relation to *Hendersonia* as *Stagonosporopsis* to *Stagonospora*, and the additional septa in its conidia arise just as described by Diedicke in *Stagonosporopsis*. The author accordingly refers it to a new genus *Phaeostagonosporopsis* (*Hendersoniopsis* being already in use for another genus), and furnishes Latin diagnoses of the genus and of *P. zeae* (Schw.) Woronich.

An account is given of American observations on the disease caused by this parasite and of the methods recommended for its control.

CARNE (W. M.). **A brown rot of Citrus in Australia (Phytophthora hibernalis n. sp.).**—*Journ. Roy. Soc. Western Australia* xii, 3, pp. 13–41, 4 pl., 1925. [Received February, 1926.]

In this paper the serious fruit rot, leaf blight, and twig die-back of Australian citrus trees, preliminary studies on which have already

been noticed [see this *Review*, iv, p. 277; v, p. 89], is fully described. The disease, which has been known since 1916, but only came into prominence in 1921, has been found to be due to *Phytophthora hibernalis* n. sp. [Latin and English diagnoses of which are given]. This pathogen is stated to be identical with the unnamed species of *Phytophthora* recently described by Moniz da Maia [see this *Review*, iv, p. 665] as responsible for a fruit rot of citrus in Portugal and probably in other Mediterranean countries.

P. hibernalis has been in the past mistaken for *Pythiacystis* [*Phytophthora*] *citrophthora*, which has been reported to occur in the States of Victoria, South Australia, Western Australia, and Queensland. The author, however, is unable to find any clear evidence that the latter fungus occurs at all in Australia. From the symptoms described he thinks it highly probable that all the records refer to *P. hibernalis*. The latter is active only during the cooler season (May to October) under conditions of high atmospheric and soil humidity. Up to 75 per cent. of the fruit of individual trees may be lost, while heavy damage may also be caused by leaf and twig blighting. Early varieties of oranges are particularly susceptible to the disease; mandarins [*Citrus nobilis*] suffer severely both from leaf and fruit infection; while lemons are chiefly attacked by leaf blight.

Affected orange and mandarin fruits develop a dull dark brown area, usually beginning on one side and spreading over the whole fruit. The rot is accompanied by a distinct penetrating odour. Eventually the affected areas become dark, dry, and sunken, unless (as frequently happens) secondary infection is produced by various organisms. Affected parts of lemon fruits develop a straw colour, and the distended skin is abnormally smooth and glossy. Secondary infection (especially by *Oospora citri-aurantii*) is frequent in this case also.

Affected leaves of all the susceptible citrus plants develop dark, water-soaked areas, usually at the tips, part of the margins also being gradually involved. Complete defoliation is not common in oranges and mandarins, in which, as a rule, the affected portion is restricted to a vertical strip varying in breadth from two or three feet to the entire width of the tree. Such cases are generally observed on the eastern or southern side, and in severe leaf attacks the fruit is invariably also affected. On lemons, however, the infection is more uniform over the whole tree, and complete defoliation may occur without the fruit being attacked. These differences in symptoms led the author at first to consider the diseases on the two hosts as distinct [see this *Review*, iv, p. 278]. Severe defoliation is accompanied by a die-back of the smaller twigs and branches, which interferes with fruit-bearing in the following season.

The fungus was isolated in 1923, 1924, and 1925 from infected fruit in Western and South Australia and cultured on a variety of media, of which potato dextrose agar proved the most satisfactory. Oranges and lemons were readily infected by isolations from the same hosts, but the author was not able to demonstrate that the fungus from one host would attack the other. The fungus is identical on both, but it appears possible that they are different biological strains.

The morphology of *P. hibernalis* is described. The fungus is characterized by the presence of persistent, long, slender pedicels on the conidia, which are borne terminally on slender conidiophores 1 to 2 μ in diameter, and usually arising from a swelling on the aerial hyphae in culture. On the host they arise, often in clusters, from a stromatic mycelial mass below the epidermis. The conidia are elliptical or lemon-shaped (occasionally pear-shaped) and measure 17 to 56 by 10 to 28 μ, with an average length to breadth ratio of 2:3. The oospores measure 22·5 to 45·6 and the antheridia are amphigynous or very occasionally paragynous [see this *Review*, ii, p. 182]. The optimum temperature for growth is about 12° C.

P. hibernalis is stated to belong to the *Phaseoli* or *Infestans* group of *Phytophthora*, but to be readily distinguishable from the other members of the group and also from *P. citrophthora* by characters which are detailed. Particular attention is given to the distinction between it and the last-named species, which with *P. terrestris*, both obtained from California, were subjected to comparative study.

P. hibernalis probably passes the summer in the oospore stage, conidia being formed on or in the soil from germinating oospores after the winter rains in May or June, and blown on to the lower parts of the trees by the driving winds which frequently occur at that season. The incubation period is about ten days. Secondary infection occurs during or after wet weather as a result of the production of conidia in the affected parts of the tree; and finally oospores are again produced in fallen leaves and fruit. Infection ceases about October with the rising temperature. Brief directions are given for the control of the disease [see this *Review*, v, p. 89].

DOIDGE (ETHEL M.). **Scaly bark (psorosis) of Citrus trees.**—*Journ. Dept. Agric. S. Africa*, xii, 1, pp. 61–67, 2 figs., 1926.

This is an account of the serious bark disease of citrus trees which was briefly described in 1896 by Swingle and Webber in Florida, under the name of psorosis (see also this *Review*, ii, p. 542]; it is more generally termed scaly bark, but the author considers that the name psorosis should be retained to distinguish it from the Florida scaly bark or nail-head rust, caused by *Cladosporium herbarum* var. *citricolum*.

The first apparent symptom of the disease is an inconspicuous cracking and raising of the bark on one or more small areas, not over half to one inch in diameter, usually on the trunk or one of the larger limbs. At this stage, only the outer layer of the bark appears to be affected, the inner layer next the cambium being still alive and free from discoloration, except a slight greenish appearance in some cases. The progress of the disease is characterized by the detachment of irregular scales of bark, one-quarter to one inch in diameter, which peel off, leaving an inner layer of bark still alive. The latter frequently forms a new, much thickened, rough, and yellowish brown bark, occasionally with a slight exudation of gum. The disease progresses most rapidly in a longitudinal direction, but it also extends laterally until it finally encircles the trunk or limb. When it is exceptionally severe, long strips of bark sometimes become slit and curl outwards. Later on, the deeper layers of bark,

and even the wood, may become affected and discoloured. When the larger limbs and the trunk are extensively affected, the trees are stunted and reduced to a very poor condition.

Although the cause of the disease is as yet unknown, evidence from Fawcett's and the author's inoculation experiments suggests that the immediate cause is an organism of some kind, which is able to advance very slowly, as in one of Fawcett's experiments two years elapsed after inoculation before any sign of the disease was noticed. Its infectious nature has, however, been clearly established.

In California, where the disease is of long standing and causes heavy losses, some measure of success has been achieved in treating the early stages of the disease by scraping rather deeply the affected bark and the surrounding, apparently unaffected surface from four to six inches in all directions from the margins of the lesion, and by painting over the wound with a disinfectant. Badly infected trees, however, are not amenable to treatment, and should be removed from the orchards.

In South Africa, scaly bark was first reported in 1918 from the northern Transvaal and since then has been found to be fairly widespread in the Marico, Rustenburg, and Pretoria districts, and also in certain other localities. It is proposed to make an early survey of all the citrus orchards of the Union, and it is believed that cases of infection will be found in many localities. The disease is also known to occur at Gwelo in Rhodesia. So far, however, the percentage of infected trees does not appear to be very high, except in a few isolated cases, and the author considers that the best policy for checking the slow, but steady, advance of the infection in South Africa is the prompt eradication of all diseased trees.

McDonald (J.). **Fungoid diseases of Coffee in Kenya Colony.**—*Kenya Dept. of Agric. Bull.* 3, 17 pp. [Received February, 1926.]

This bulletin is stated to contain the most recent information on Kenya coffee diseases, classified under leaf, berry, stem, root, nursery, and physiological diseases.

The leaf diseases comprise *Hemileia vastatrix* [see this *Review*, iv, p. 591]; brown blight (*Colletotrichum coffeanum*) [*Glomerella cingulata*: see this *Review*, i, p. 3]; brown eye spot (*Cercospora coffeicola*) [see this *Review*, ii, p. 408]; and sooty mould (*Capnodium brasiliense*).

Two distinct berry diseases, brown blight and coffee berry or black berry disease [see this *Review*, v, p. 17], are both considered to be caused by *C. coffeanum*, more than one physiological strain of which is believed to attack coffee in Kenya [loc. cit.]. The latter was, for a time, the most serious disease in Kenya plantations, especially in certain districts, but remedial measures have effected a considerable improvement.

The stem diseases referred to are pink disease (*Corticium salmonicolor*) [see this *Review*, iv, p. 261]; anthracnose (*C. coffeanum*), which is of rare occurrence and causes little damage; and die-back, a disease of physiological origin, generally associated with over-

bearing. This disease is responsible for heavy losses under unsuitable cultural conditions [see this *Review*, ii, p. 409].

Root diseases include one similar to that attributed in Uganda to *Armillaria mellea* [see this *Review*, iii, p. 509], though rhizomorphs have not been seen; another resembling brown root disease (*Fomes lamaoensis*) [see this *Review*, ii, p. 409]; *Sclerotium* [*Rhizoctonia*] *bataticola* [see this *Review*, v, pp. 18, 20]; and the so-called mealy bug root disease [*Pseudococcus citri* and *Polyporus coffeae*: see this *Review*, v, p. 17], first observed in October 1925.

A damping-off of nursery seedlings is caused by *Rhizoctonia solani* [see this *Review*, v, p. 17]. The fungus was also found in the roots of dead strawberries and antirrhinums situated within a few miles of the affected coffee, and cross-inoculations on the latter host gave positive results.

Black tip, which is most prevalent at altitudes of 6,000 ft. and above, is characterized by a blackening of the extremities of the branches and some of the leaves, accompanied by crinkling and a yellow discoloration of the rest of the foliage, and considerable bunching of the secondary and tertiary branches. The condition, which is believed to be due to sunburn and excessive fluctuations of temperature, may be ameliorated by the provision of suitable shade.

Directions are given for the preparation of Bordeaux and carbide mixtures [see this *Review*, i, p. 51] and a soda-resin sticker, and for their use in the control of several of the diseases described.

Toro (R. A.). **La caída de las bellotas del Algodón.** [The dropping of Cotton bolls.]—*Rev. Agric. Puerto Rico*, xvi, 1, pp. 17–18, 1926.

The surprising fall of cotton bolls (up to 20 per cent.) observed recently in the coastal districts of Porto Rico was attributed at first to the attacks of *Diplodia gossypina*, as several bolls examined were infected by this fungus. Others, however, showed no signs of disease, and the author is convinced that the cause must have been purely physiological.

Dropping of the bolls, such as has been observed in Porto Rico, begins immediately after they form, and may continue with more or less intensity until the ripening period. Before dropping, they lose their natural green coloration. Some of the smaller bolls die off, but will only drop if they are touched or the plant is shaken. The fall of the bolls is interpreted as a means by which the plant adjusts itself to changes of weather. An abundance of flowers may be produced, for the subsequent development of which the plant has insufficient nutriment at its disposal in the event of a period of heavy rains, with high temperature and vigorous transpiration, being succeeded by drought. A certain number of bolls are then shed in order that the remainder may mature normally. As an insufficiency of moisture in the soil during the flowering and fruiting periods is considered to be the principal cause of the dropping, methods of control should be based on the conservation of soil moisture. Suggestions for securing this are given.

FIELITZ (H.). **Untersuchungen über die Pathogenität einiger im Bienenstock vorkommenden Schimmelpilze bei Bienen.** [Investigations on the pathogenicity to bees of some moulds occurring in the hive.]—*Centralbl. für Bakt.*, Ab. 2, lxvi, 1–7, pp. 28–50, 6 figs., 1925.

In addition to the parasites *Pericystis apis* and *Aspergillus flavus*, a number of other moulds occur in the bee-hive which are associated with a mummification of adult bees or larvae. The writer undertook a series of experiments [details of which are given] to ascertain whether these organisms were pure saprophytes or if, under certain conditions, they could infect and kill healthy bees.

The fungi used in the tests comprised two strains each of *Penicillium glaucum* and *Mucor mucedo* and one of *Trichoderma lignorum*, all isolated from mummified bees or larvae.

Honeycombs on which fructifications of the experimental fungi had developed were hung in the brood-chambers. In two tests with *T. lignorum* one bee of each brood became infected, while one strain of *M. mucedo* attacked the embryos in covered cells. Both these organisms, therefore, are capable of parasitic action under certain conditions. The experiments with *P. glaucum* gave negative results.

Notes are given on the morphological and cultural characters and physiological reactions of the strains studied, and a bibliography of 59 titles is appended.

SARTORY (A.) & SARTORY (R.). **Etude d'un Scopulariopsis isolé dans un cas d'onychomycose.** [Study of a *Scopulariopsis* isolated from a case of onychomycosis.]—*Bull. Acad. Méd.*, Sér. 3, xciii, 25, pp. 707–709, 1925.

From the nails of a patient a fungus was isolated which formed a spreading mycelium with numerous erect, branched hyphae, 2 to 4 μ in thickness, on Raulin's medium. A large number of conidiophores were observed. These were sometimes sufficiently differentiated to be termed phialids; they measured 6 to 9 by 2 to 3 μ and bore at their apex a circle of conidia averaging 3 to 4 μ in diameter. The optimum temperature for growth was 26° to 27° C. Gelatine and agar were not liquefied. The cultural characters of the fungus on a number of ordinary media are briefly described.

The organism is believed to be a new species of *Scopulariopsis*.

SARTORY (A.) & SARTORY (R.). **Deux cas d'oosporoses pulmonaires guéries provoquées par un champignon du genre 'Actinomyces' (Oospora).** [Two cured cases of pulmonary oosporosis caused by a fungus of the genus *Actinomyces* (*Oospora*).]—*Bull. Acad. Méd.*, Sér. 3, xciv, 32, pp. 893–894, 1925.

Particulars are given of two cases in which patients suffering from pulmonary oosporosis were cured by appropriate treatment. The causal organism was a fungus (believed to be a new species of *Actinomyces*) with very slender hyphae, measuring 0·4 to 0·5 μ in width and of variable length, bearing two kinds of branches: one with a verticillate apex and the other forming an apical chain of arthrospores with maximum dimensions of 0·5 to 0·6 μ. No growth

was obtained on ordinary media, but cultures were readily developed on banana, carrot, and liquid or solid maltose media. The fungus was pathogenic to guinea-pigs and rabbits.

JAUMAIN (D.) & COLARD (A.). **Sur les caractères d'un champignon du genre Monilia isolé dans un cas mortel de mycose pulmonaire, contracté au Congo belge.** [The characters of a fungus of the genus *Monilia* isolated from a fatal case of pulmonary mycosis contracted in the Belgian Congo.]—*Comptes Rendus Soc. de Biol.*, xciii, 28, pp. 858–860, 1925.

From the end of 1924 to June 1925 the authors attended a French officer repatriated from the Belgian Congo on account of serious chronic pneumonia and general deterioration of health. An examination of the sputum revealed the constant presence of oval refractive bodies, measuring 4 to 5 by 2 to 3 μ and frequently in pairs. These were suspected to be responsible for the diseased condition of the lungs.

The organism, which was identified as a species of *Monilia*, was readily cultivated on Raulin's and Sabouraud's media. The optimum temperature for growth was 37° C. On solid media the colonies consisted almost exclusively of yeast cells, only a few abortive mycelial elements being formed. In liquid carrot extract some pellicle formation occurred and there were large numbers of free cells and of branched hyphae bearing terminal chlamydospores. Gelatine was liquefied, milk coagulated, and galactose and saccharose fermented. These and other biochemical reactions [which are briefly enumerated] preclude the identification of this species with any of those described by Castellani.

The organism was pathogenic to rabbits, causing death in 48 hours when injected into the lungs and more rapidly when inoculated intravenously: it was reisolated from the affected organs.

The same fungus was isolated from ulcers in the mucous membrane of the patient's mouth and pharynx shortly before his death.

CATANEI (A.). **Sur la pathogénie de la langue noire pileuse.** [The pathogenicity of the black furred tongue.]—*Comptes Rendus Soc. de Biol.*, xciii, 37, pp. 1492–1494, 1925.

For over two years the writer has been studying a case of 'black tongue' in a patient aged 83. In 1923 a species of *Cryptococcus*, together with a black organism, was isolated from the lesions; twice in 1924 the same *Cryptococcus* and a *Monilia*; and in 1925 these two fungi and a new black species. Inoculation experiments with these cultures on guinea-pigs and rabbits gave negative results, and even when placed on the tongues of monkeys (*Macacus inuus*) or guinea-pigs the organisms produced no disturbance.

Discussing the etiology of the condition, the writer considers that no satisfactory evidence has been furnished for the suggested parasitic rôle of *C. linguae-pilosae* and *Nocardia* [*Actinomyces*] *guegenii*. It is more probable that the hypertrophy and elongation of the papillae, developing as a result of inflammation or other causes connected with general health, produce a condition facilitating the growth of a number of different organisms. One or more

of these may be involved in the causation of certain phenomena associated with the final disturbance, but their rôle is in any case secondary to the above-mentioned modifications of the lingual tissue.

Henry (A. W.). **Browning disease of Flax in North America.**—*Phytopath.*, xv, 12, pp. 807–808, 1925.

The browning disease of flax (*Polyspora lini*) [see this *Review*, i, pp. 173, 176] was first observed by the writer at Saskatoon, Saskatchewan (Canada) in 1920, and in 1923 it was reported to be capable of causing severe injury in the same locality [see this *Review*, iii, p. 442]. The fungus was found to remain viable on diseased leaves for over four years, and attention is drawn to the danger of its transmission on infected seed.

In August 1925, specimens of flax infected by *P. lini* were received from Michigan. Part of the seed from which this crop was grown came from Ontario. This is believed to be the first record of browning in the United States.

The stem break phase of the disease [loc. cit.] has not been much in evidence.

An organism from diseased flax collected in Minnesota in 1924 and reisolated from artificially inoculated plants in 1925 was found to resemble *P. lini*, but was not identical with the latter.

Lange (S.). **Nochmals: uspulun für die Vermehrung.** [Further observations on uspulun in propagation work.]—*Gartenwelt*, xxix, 51, pp. 846–847, 1925.

The writer reports excellent results in the control of the 'rot fungus' [? *Botrytis cinerea*] on *Begonia semperflorens* and *Cineraria* by sprinkling with a 0·25 per cent. solution of uspulun. All trace of infection disappeared in a single night and there was no recurrence. On the other hand, an attempt to eliminate the 'propagation fungus' [*Moniliopsis aderholdi*: see this *Review*, v, p. 172] by soil treatment with uspulun was a complete failure.

Laubert (R.). **Die Krankheit der Yucca.** [The Yucca disease.]—*Gartenwelt*, xxix, 26, pp. 411–412, 1 fig., 1925.

In the Ticino valley (Switzerland) yuccas (chiefly *Yucca gloriosa*) growing out-of-doors are attacked by a disease producing on the leaves elliptical, dingy purplish-brown spots, with a paler, brownish-grey centre, and covered, especially on the upper side, with minute, black dots, sometimes concentrically arranged. The affected tissues are traversed by hyphae and the black dots are the globular pycnidia of *Coniothyrium concentricum*. They contain innumerable unicellular, broadly oval, yellowish-brown spores, measuring 6 to 10 by 4 to 6 μ in diameter, these dimensions being slightly larger than those given in the literature.

The fungus, which occurs also on *Dracaena*, *Dasylirion*, *Fourcroya*, *Agave*, and the like, is believed to be practically coextensive with its hosts. Control measures should be based on thorough sanitation and the application of an adhesive fungicide.

ALEXANDER (W. B.). **Natural enemies of Prickly Pear and their introduction into Australia.**—*Australian Inst. Sci. and Indus. Bull.* 29, 80 pp., 13 pl., 1925. [Received March, 1926.]

In this bulletin an account is given of the work of the Commonwealth Prickly Pear Board during the first four years (June 1920 to June 1924) of its operation under the joint auspices of the Commonwealth, Queensland, and New South Wales Governments.

The fungous and bacterial diseases of the prickly pear (*Opuntia* spp.) are discussed on pp. 65–74. Cultures of the following fungi were obtained in Australia from material collected in America: *Gloeosporium lunatum* [see this *Review*, ii, p. 397], *G. cactorum*, *G. venetum*, *Hendersonia opuntiae*, *Macrophoma opuntiarum*, *Cladosporium* sp., and *Macrosporium* sp. The condition produced by the two last-named fungi in America is stated to be already generally present on prickly pears in Australia. *G. lunatum* developed within 48 hours on Dox's medium lunate-fusoid, hyaline, obtusely rounded, generally unicellular conidia, measuring 12 to 20 by 2 to 3 μ. This organism induced a diseased condition on inoculation into *O. inermis*, *O. stricta*, *O. monacantha*, and *O. aurantiaca*. All attempts to secure the development of perithecia were unsuccessful.

The material brought from South America as *Montagnella opuntiarum* closely resembled *Sphaerella opuntiae*, which is stated to be the perfect stage of *G. lunatum*. The general appearance of this *Sphaerella* suggests its classification with the Dothideaceae, but the South American material was too scanty to determine the relationship, if any, between this genus and *Montagnella*.

Conidia of *Gloeosporium cactorum* and *G. venetum* grew well on a modified Dox's medium, in which maltose was substituted for saccharose. The conidia of *G. cactorum* are elliptical with maximum dimensions of 4 by 2 μ, while those of *G. venetum* are oblong and measure 5 to 7 by 3 μ. Attempts to cause disease in *Opuntia* by inoculation with pure cultures of these organisms were unsuccessful.

Hendersonia opuntiae has brown, triseptate pycnospores, ranging from 12 to 16 by 4 μ. On germination each spore swells until it resembles four superimposed balls, each of which may send out a hyaline, non-septate germ-tube, measuring about 4 μ in width. The optimum temperature for growth is approximately 30° C. This fungus is stated frequently to develop on lesions made by *Sphaerella* and *Montagnella*. Subcutaneous inoculations on *O. inermis* and *O. stricta* produced minute, scale-like lesions similar to the condition known as sun scald.

The pycnospores of *Macrophoma opuntiarum* are hyaline, unicellular, containing one or more oil drops, and measuring 12 to 20 by 4 to 8 μ, though in some pycnidia a smaller type of spore was also present. This fungus grew well on the maltose medium, pycnidia being produced in about three months at 22° to 25°. Inoculations on *O. inermis* were very successful, the resulting disease proving highly destructive.

G. venetum was found to be pathogenic to apples, but in no case did any of the other six fungi tested infect the various economic plants inoculated with them.

The only bacterial organism which appears at all promising is

Bacillus cacticidus [see this *Review*, iii, p. 706]. Inoculations with this organism were successful in causing infection of squashes, melons, and marrows, in which complete dissolution of the parenchyma was produced, and of potatoes kept at a temperature of 37°, but gave negative results on the other economic plant tested.

RIKER (A. J.) & KEITT (G. W.). **Second report of progress on studies of crown gall in relation to nursery stock.**—*Phytopath.*, xv, 12, pp. 805–806, 1925.

The isolation studies previously reported [see this *Review*, v, p. 83] have been extended to 227 apple trees, representing stock sent in as crown gall (*Bacterium tumefaciens*) rejects by twelve nurseries in six States. Less than 2 per cent. of these trees yielded *Bact. tumefaciens*, which was isolated exclusively from overgrowths of the soft gall type. Most of the malformations on the trees from which the crown gall organism was absent appear to be attributable to misfits and other imperfections in the technique of grafting.

CHABROLIN (C.). **Quelques maladies des arbres fruitiers de la vallée du Rhône.** [Some diseases of fruit trees in the Rhone valley.]—*Ann. des Epiphyties*, x, 5, pp. 265–333, 5 pl., 36 figs., 1924. [Received March, 1926.]

The present paper deals with the diseases of fruit trees prevalent in the area comprised between Valence, in the south, and Lyons, in the north, in the valley of the Rhone, where the fruit-growing industry is stated to be of considerable economic importance [see this *Review*, i, p. 180].

During the hot and dry summer of 1921, the apricot, which is usually grafted on the plum in this region, died in large numbers, in some orchards the mortality being as high as 40 per cent. [see also this *Review*, i, p. 385; ii, p. 119]. The two principal causes of the death of the trees were root rot induced by *Armillaria mellea*, and apoplexy, which is believed to be of physiological origin, as repeated attempted isolations from various parts of the diseased trees failed to yield any organism and inoculation experiments gave negative results. The general symptoms of apoplexy are not specific to it alone, and, especially in the initial stages, merely consist in the unthrifty appearance of the trees, with a drooping foliage paler than the normal. Later on, brown patches appear in the middle layer of the phloem at the base of the limbs, and at a still more advanced stage, more or less extensive areas of the bark are killed on the branches and trunk. In severely affected trees, doomed to an early death, there may be a premature spurt of leaf formation in November or December, or in the spring, when the leaves may appear a few days before the blossoms. Branches in an advanced stage of disease do not bear flowers, and the tips of the preceding year's shoots are dead. The fruit, if any, on the trees that are to die shortly, is matured prematurely in June or July, and, although of normal aspect, has a very unpleasant taste; the flesh is dry, greyish-brown near the stone, and does not adhere to the latter. The final stage is the rapid death of the tree down to the plum stock, but the latter is not affected. The primary cause of the disease is still obscure, but the indications are that the

immediate cause of the rapid death of the trees is excessive heat and drought, as in 1921, a confirmation of this being that in 1922 very few new cases were seen, and in 1923, although the number of diseased trees was again rather large, the mortality was low. Very little is also known as regards the control of the trouble, the only recommendation being the early removal and burning of dead branches, and the excision of the dead cortical tissues in their proximity.

The other diseases of the apricot described are: *Rosellinia necatrix*, rare in the Rhone valley; *Monilia* (*Sclerotinia*) *cinerea*, attacking the shoots, blossoms, and fruit; *Coryneum* [*beijerinckii*] on the leaves and fruit; rust (*Puccinia pruni-spinosae*); mildew (*Podosphaera oxyacanthae*); *Polyporus fulvus*; and *Stereum hirsutum*. *Coriolus hirsutus*, usually a saprophyte, was observed on one living tree, growing at the level of the graft.

Notes are also given on *Exoascus* [*Taphrina*] *deformans*, *Coryneum* [*beijerinckii*], *Polyporus fulvus*, *Stereum hirsutum*, and chlorosis of the peach; *Gnomonia erythrostoma* on the cherry; and *Sphaeropsis pseudo-diplodia* [*Physalospora cydoniae*] on the pear.

A bibliography of 79 titles is appended.

Harris (R. V.). **An unusual form of Pear canker.**—*Ann. Rept. East Malling Res. Stat., 1st January, 1924, to 31st December, 1924*, pp. 135–136, 1 pl., 1925. [Received March, 1926.]

In September 1924 an extensive withering and discoloration of a trained Beurré Diel pear tree was observed at West Malling (Kent). The symptoms were found to be associated with a localized blackening and shrinkage of the base of the petiole at its point of attachment to the shoot, and subsequent observation showed that the wilting was preceded by the appearance of a black spot at the lower end of the petiole, which was finally girdled. At this stage the leaf blade usually showed signs of curling, followed by the appearance of discoloured areas. As a rule the discoloration of the blade, which was apparently due to infection from the petiole, was complete before the blackening of the latter had reached its upper limit. Scab [*Venturia pirina*] lesions were numerous on the blade and petiole.

During the early stages of leaf wilting, the affected leaves were readily detached prematurely. The numerous dead leaves which remained attached to the shoots became completely blackened and mummified. Cankered areas developed round the bases of many of the affected leaves, which produced minute pustules bearing spores resembling those of the *Fusarium* stage of *Nectria galligena* under laboratory conditions. A number of the 1924 shoots bearing withered foliage did not develop cankered areas until February 1925, when pustules of spores were produced round the scars of the infected leaves.

Infection of the canker fungus through leaf scars and scab lesions has been described by Wiltshire [see this *Review*, ii, p. 318], but the infection of current year's shoots through the bases of leaves still on the trees appears to have been hitherto unrecorded.

CAMPBELL (W. G.). **Note on an Exoascus disease on Prunus amygdalus var. amara.**—*Trans. & Proc. Bot. Soc. Edinburgh*, xxix, 2, pp. 186–191, 4 figs., 1925.

For several years past a species of *Exoascus* [*Taphrina*] has caused a die-back of the twigs and a discoloration, hypertrophy, and general deformation of the lamina and petioles of the leaves of bitter almond trees (*Prunus amygdalus* var. *amara*) in the Botanic Garden of St. Andrews University. A sweet almond (*P. amygdalus* var. *dulcis*) in close proximity to an infected bitter one has also contracted the disease.

Crimson patches appear on some of the leaves before they open, while the upper surface of the petioles may also be involved. As the leaves expand, the coloured areas increase in size and an upward involution of the margins occurs; later a marked puckering is observed between the veins, and a noticeable thickening is apparent in the diseased areas. Totally diseased leaves are about three times as wide and one-fifth longer than the normal, while the affected laminae are two to three times the normal thickness. Diseased petioles are three times the normal width at their widest part, and the average weight of the totally diseased leaf is approximately eleven times that of the normal.

A marked difference in stomatal distribution has also been observed, the number in the diseased leaf being only 80 to 90 per sq. mm., compared with 160 in healthy specimens. By August all the diseased leaves have fallen and the trees appear free from infection, though the crown of foliage is rather thin.

The fungus hibernates in the walls of the phloem elements of the shoots. At an early stage no hyphae are discernible in the leaf, though the crimson coloration may be apparent. This would indicate either that the hyphae are extremely minute or that their development is preceded by a secretion from the fungus. At a later stage hyphae have been observed in the intercellular spaces and between the walls of the upper epidermal and mesophyll cells. Ultimately a subcuticular mycelium is formed, from which the clavate, stalkless asci arise in June and July. Each ascus contains six to eight sub-spherical, distichous ascospores. The asci measure 34 by 11 to 12 μ and the ascospores 7 by 5 μ. Conidia have also been observed.

In the infected leaves the long axis of the epidermal cells is perpendicular to the surface, so that the cells form a palisade. The outer exposed wall is almost twice the normal thickness. Most of the cells contain anthocyanin. In the mesophyll there is no differentiation into palisade and spongy tissue and the chlorophyll disappears. In the diseased leaf there are 15 to 20 layers of mesophyll compared with seven, at the most, in normal foliage. Intercellular spaces are hardly discernible, being probably obstructed with hyphae. The sap of diseased leaves is distinctly more acid than the normal (P_H 5·5 compared with 6 to 6·5).

The fungus concerned differs in various details from *Exoascus* [*Taphrina*] *deformans*. There is no hypertrophy of the twigs before death, the asci are stalkless and occur on the upper surface only, while their dimensions and those of the ascospores differ from those of the leaf curl fungus. However, the general character and

life-history of the almond fungus, as well as its effects on the host, are considered to agree sufficiently with *T. deformans* to justify its classification as a variety of that species.

MASSEE (A. M.). **Part IV. Entomology. Programme of research with brief progress reports.**—*Ann. Rept. East Malling Res. Stat., 1st January, 1924, to 31st December, 1924*, pp. 139–142, 1925. [Received March, 1926.]

A brief account of an investigation into the causes and transmission of reversion in black currants [see this *Review*, iv, p. 680] is given on p. 141 of this report. Observations made in 1922 and 1923 have shown that whenever the combination of healthy and diseased individuals by grafting and inarching succeeded, the healthy plant became definitely 'reverted' in the second season. In another series of tests, buds which would not normally have developed in the current season were forced into immediate growth by the removal of all well-developed buds from the plants. The forced buds uniformly manifested temporary symptoms of reversion. Since 1921 a very high percentage of previously healthy currant seedlings have shown symptoms of reversion after direct infection with mites [*Eriophyes ribis*].

ALCOCK (Mrs. N. L.). **A note on Raspberry canker (Nectria rubi Osterwalder.)**—*Trans. & Proc. Bot. Soc. Edinburgh*, xxix, 2, pp. 197–198, 1925.

During the summer and autumn of 1925 the author investigated a disease of raspberry canes from Beaufort Castle, Inverness.

The canes had been turning yellow and dying sporadically and more or less rapidly.

Numerous perithecia were found on the base of the stems and at the collar. They were small, round, 300–500 μ in diameter, red when immature but turning purple or almost black at maturity, and with an ostiole that projected slightly, making the whole fructification conical in shape. They occurred in clusters or singly below the soil surface, frequently at the angle where cane and root meet and also in cracks.

The fungus was identified as *Nectria rubi* and its morphological characters are briefly described. It is said to have a *Fusarium* stage, and conidia of this type were found on the affected roots.

The disease is also known to occur in Ireland.

Section IV. The preservation of fruit and vegetables.—*Dept. Sci. & Indust. Res. Rept. Food Invest. Board for the year 1924*, pp. 26–61, 22 graphs, 1925.

The researches in progress under the Fruit and Vegetable Committee of the Food Investigation Board, Department of Scientific and Industrial Research, at Cambridge, London, and Long Ashton, centre round three main lines of study, namely, the effect of temperature upon metabolic balance, the change of condition with age, and the effect of such changes upon susceptibility to fungous diseases. The results during the year 1924 are summarized in a series of abstracts prepared by the various workers. Amongst others the following points are brought out.

The ultimate death of apples is usually brought about either by fungal decay or functional disease, the latter being the more common in cold storage. With the onset of internal breakdown [see this *Review*, iv, p. 173] there appears to be a marked acceleration of metabolic activity made evident by the rise of respiratory activity and the increase in the rate of loss of acid. There is some evidence that the cell wall begins to disintegrate and the nitrogen appears to decrease.

Fungal invasion in relation to age has been already shown by Mrs. Kidd and Beaumont [see this *Review*, iv, p. 484] to start frequently in the lenticels, and as a result of their experiments it is thought probable that two stages of fungal attack exist, namely, the formation of a spot due to a degree of local senescence at the lenticel, which may be in advance of the general senescence of the tissues, and an active progressive invasion of the rest of the tissues when a certain degree of general senescence sets in. Fungal attack is stated in fact to be an accurate indicator of a certain late stage of senescence, and the curves of fungal invasion at progressive intervals of time have been found to correspond in a general way to those of mortality of fungus spores exposed to the action of a killing agent [see this *Review*, iii, p. 536].

The relative importance of the principal rot-producing fungi has already been noticed in a preceding report [see this *Review*, iv, p. 226]. Kept at two different temperatures (15° and 8° C.) the percentage of attack by the different species varies, *Diaporthe perniciosa* and *Penicillium* spp. being the worst at the former and *Polyopeus* spp. at the latter.

The results of a study of the resistance of the internal tissues of apple fruit to different fungi when inoculated subcutaneously indicate that there is a marked difference in the degree of susceptibility in the same variety grown in different localities and also from season to season. Of the various fungi tested in this way *Botrytis* sp., *Penicillium glaucum*, *Fusarium blackmani*, and *Cytosporina ludibunda* were found to be the most active rot producers at 1° C.

It appears that the factors contributing to the greater resistance to rot of sour apples persist after death, and are related to acidity and hydrogen-ion concentration.

Preliminary studies of fungal attack on apples in relation to the nature and concentration of the sugar content have shown that *Cytosporina ludibunda* and *Fusarium blackmani* possess the power of inverting sucrose while *Pleospora pomorum*, which was the least active of the organisms tested in causing rotting of the internal tissues, is a very feeble inverting agent. In all cases the amount of glucose utilized in culture media is much higher than that of fructose, and the dry weight of the mycelium is also higher in solutions containing the former.

It is observed that the optimum temperature for storing any particular variety corresponds with the point at which the combined loss arising from fungal attack (which diminishes with a falling temperature) and functional disease such as internal breakdown (which is generally greater at the lower temperatures) is at a minimum. This temperature differs according to the variety; for

example, an optimum of 34° F. may probably be safely recommended for Bramley's Seedling apples, whereas from 36° to 37° appears to be the best for King of the Pippins, and 30° for Newton Wonder.

BARKER (B. T. P.) & GROVE (O.). **Sulphur dioxide as a preservative for fruit.**—*Journ. Pomol. and Hort. Science*, v, 1, pp. 50–60, 1925.

This paper contains a detailed description of a method by which fruit can be preserved for a considerable time in a dilute solution of sulphur dioxide.

The results of experiments with fresh fruit of a varied nature under different storage conditions show that the most satisfactory strengths for the preservative fluid, which was prepared by passing the gas into cold water until the water contained 4 to 5 per cent. (the exact amount being determined by titration with iodine) and then diluting, range from 0·08 to 0·1 per cent. sulphur dioxide. The fruit should be prepared as for bottling and then placed in air-tight storage vessels, adding small quantities of the aqueous solution of the preservative to avoid solid massing, and then sufficient to cover completely the fruit before sealing down. This relatively large bulk of the preservative solution is required because the strength is gradually reduced on prolonged storage (in some cases to one-fifth the original strength, after eight months) owing to oxidation to sulphuric acid or sulphates, or to combination with constituents of the fruit, the latter being probably the more important.

Tests of the preservation of whole fruit and fruit pulp, in bulk, in casks which are not air-tight, indicated that whole fruit kept sound for an unexpectedly long time when the casks were securely bunged. The results with pulp, however, were very irregular.

A noticeable bleaching is produced in the fruit by the preservative solution, especially in the red fruits. Yellow and green fruits are little affected by the 0·08 per cent. solution. The loss of colour is temporary and is restored when the sulphur dioxide is driven off, as by cooking or jam making. More permanent effects are a loss of setting power, due to a reduction in 'gel' value, possibly from a gradual hydrolysis of the pectin in an acid medium. A hardening effect on the skin of the fruit is also produced, and is a definite disadvantage which has not yet been overcome.

Although a 0·08 per cent. strength is necessary to allow for the weakening due to absorption by the fruit, a concentration of approximately 0·04 per cent. is sufficiently toxic to inhibit the growth of micro-organisms. This figure is thus of significance in connexion with the use of sulphur dioxide in the preservation of wines, cider, and other beverages. Actually the amount of sulphur dioxide remaining in the fruit when there is no attempt to remove the antiseptic is no greater than is permissive by French law in wine and cider; and in heating the fruit for use it is practically all driven off.

The main result of the work is considered to be the establishment of the fact that whole fruit may be preserved for long periods by a simple method, the quality of the jam made being almost

equal to that made from fresh fruit. In plum jam made after eight months' storage the amount of sulphur dioxide found was only 0·003 per cent.

GODDARD (E. J.). **Bunchy top in Bananas.**—*Queensland Agric. Journ.;* xxiv, 5, pp. 424-429, 1925.

This is the original paper of which the first part has already been noticed from another source [see this *Review*, v, p. 168]. In the second part the history of the Investigation Committee appointed by the Bunchy Top Control Board, since its inception in 1924, is briefly outlined. A short account is given of the preliminary phases of the work. An outbreak of the disease in healthy stock on virgin soil in January 1925 led to the experiments already described [loc. cit.], by which the common dark banana aphid (*Pentalonia nigronervosa*) was definitely implicated as the vector of the disease.

JENKINS (ANNA E.). **The Avocado scab organism.**—*Phytopath.*, xv, 12, p. 807, 1925.

Repeated artificial inoculations of the avocado [*Persea gratissima*] in the field with the citrus scab organism [*Sphaceloma citri* Jenk. or *Sporotrichum citri* Butl.] gave negative results, while similar inoculations with the avocado scab fungus uniformly resulted in the reproduction of the disease. A critical study of the avocado fungus indicates that it is an undescribed species of the form genus *Sphaceloma* [see this *Review*, iv, p. 476].

ARNAUD (G.). **Essais d'anticryptogamiques sur les arbres fruitiers et la Vigne en 1925.** [Experiments with fungicides on fruit trees and the Vine in 1925.]—*Comptes Rendus Acad. d'Agric. de France*, xii, 3, pp. 92–96, 1926.

Pear trees, chiefly of the Fondante des Bois variety, were treated at the Versailles Horticultural College with different copper fungicides for the control of scab (*Fusicladium*) [*Venturia pirina*] on 24th March, 11th May, and 23rd June. Bordeaux mixture (with or without casein) gave very good results for the first two applications, whereas the third (subsequent to the appearance of the disease on 15th June) was of little value. Where treatment during the dormant period is omitted (as it may well be in the vicinity of Paris owing to the lateness of the attacks in normal years) spring applications should be given until the first symptoms of infection are observed. Acetylene mixture (copper sulphate with ground calcium carbide) [see also this *Review*, i, p. 51] and Bordeaux mixture with oil of turpentine and resin soap were similar but slightly inferior in effect to the ordinary Bordeaux mixture.

Vine hybrids in the garden of the phytopathological station received the following treatments, on 19th and 29th June, for the control of downy mildew [*Plasmopara viticola*]: (1) 2 per cent. ordinary alkaline Bordeaux mixture; (2) 1 per cent. Bordeaux plus 0·05 per cent. casein and 0·25 per cent. lime; (3) 2 per cent. copper dioxide, casein, and lime, as in (2); and (4) casein and lime only, as in (2). The best results were given by (1) which afforded complete protection against infection (first appearance 6th July), but

(2) and (3) were also moderately efficacious, the latter being markedly successful on the foliage. The results demonstrated that the liberal and careful application of copper fungicides results in permanent protection of the treated vines, even in severe epidemics and during abnormally wet weather. Excellent results were also given in 1924 by Bordeaux mixture applied on 9th July and 23rd August.

THATCHER (R. W.) & STREETER (L. R.). **The adherence to foliage of sulphur in fungicidal dusts and sprays.**—*New York Agric. Exper. Stat. Techn. Bull.* 116, 18 pp., 1 graph, 1925. [Received March, 1926.]

Using a method based on that of Fitch [see this *Review*, iv, p. 684] with various modifications [details of which are given], the writers made a study of the adherence of sulphur, both from a lime-sulphur spray, with or without kayso, and in sulphur dust, to apple foliage. Two series of comparative treatments were carried out in the summer of 1925.

It was shown that 89 to 94 per cent. of the sulphur applied as dust was lost from the foliage during the first week, while the losses of sulphur derived from the lime-sulphur spray ranged from 45 to 75 per cent. without kayso and from 30 to 57 per cent. with the spreader. Thus there appears to be a slight beneficial effect from kayso in preventing mechanical losses of sulphur during the first week after application, but there was no conclusive evidence of any protective effect thereafter.

From the results of these experiments [which are presented in tabular form], and from the theory of the probable operation of the fungicidal action of sulphur, it appears likely that the fungicidal properties are increased in proportion to the fineness or smallness in size of the particles in which the material exists at the time of its initial application or deposition on the foliage.

FARLEY (A. J.). **New Jersey dry-mix.**—*New Jersey Agric. Exper. Stat. Circ.* 177, 8 pp., 1 fig., 1 diag., 1925. [Received March, 1926.]

This circular is stated to be largely based on the writer's previous paper [see this *Review*, ii, p. 506]. Dry-mix sulphur lime is now on the market under various trade names. It is emphasized that the mixture recommended by the New Jersey Agricultural Experiment Station contains 64 per cent. of sulphur, 32 per cent. of hydrated lime, and 4 per cent. of dry casein-lime. Any change in these proportions may lead to unsatisfactory results. Full directions are given for the preparation and application of the mixture.

HÜLSENBERG. **Trockenbeize.** [Dry seed disinfection.]—*Mitt. Deutsch. Landw. Gesellsch.*, xl, 37, pp. 687–688, 1925.

After a brief general discussion of the various types of apparatus for the dusting of seed-grain [see this *Review*, v, p. 157], the writer compares the efficiency of some of the machines now on the market.

The Ideal measures 460 mm. in length and 530 mm. in diameter, while the corresponding dimensions of the Primus are 900 and

550 mm. The drum volumes are thus in the ratio of 102 to 214 (0·102 compared with 0·214 cb. m.). The internal fittings of the Primus are stated to compare very favourably with those of the Ideal, the former apparatus effecting a more uniform admixture of the fungicide with the grain than the latter. The Primus is propelled with the aid of a flywheel which facilitates a slow, regular circulation of the drum and consequent thorough mixing of the grain, while the Ideal, which is worked by leverage, must be turned slowly and very laboriously to produce a comparable effect. The Ideal is also much more difficult to set in motion than the Primus, the former being almost top-heavy when filled with grain. The Primus is 1·50 m. in height, with a base area of 1·210 sq. m., and weighs 120 kg. with flywheel or 100 kg. with crank; the corresponding figures given for the Ideal are 1·17 m., 0·544 sq. m., and 42 kg. The Kuko apparatus (K. Konscholky, Breslau 13), which is worked like a churn, is stated to be similar, but probably inferior in efficacy, to the Ideal.

The principle of continuous working, as exemplified by the Neuhaus and Thränhardt machines, is briefly discussed, but the writer has had no personal experience of this type of apparatus, the high cost of which places it beyond the reach of most agriculturists.

Orshanskaya (Mlle V. N.). Лаборатный опыт дезинфекции почвы, зараженной грибком **Fusarium sp., 20%** -ой хлорной известью. [Laboratory experiment in the disinfection of soil infected by a species of *Fusarium*, with 20 per cent. chloride of lime.]—*La Défense des Plantes*, Leningrad, ii, 4–5, pp. 246–249, 1 fig., 1925. [Received March, 1926.]

The experiments reported in the present paper were planned to test the effect on the development of *Fusarium* of the admixture in the substratum of minute doses of chloride of lime. The strain of *Fusarium* used was isolated from the soil; in preliminary tests it refused consistently to produce sporodochia on any of the numerous artificial media tried. The experiments consisted in infecting 500 gm. of twice autoclaved earth in glass containers with cultures of the fungus on wheat grains, on which it formed sclerotia, and then adding to each container 2·5, 5, 15 mgm. (in water solution), or 25, 50, and 75 mgm. (in powder form), respectively, of chloride of lime, the whole being kept under laboratory conditions.

The results indicated that the effect, if any, of chloride of lime on the fungus is very slow, as no essential differences were noted in the development of the *Fusarium* in the control pot and in the chlorined containers, except in the case of the pot to which 5 mgm. had been added. In the latter case, four weeks after the beginning of the experiment, the vegetative growth of the fungus was completely arrested and was replaced by an intensive production of consecutive generations of conidial fructifications in the form of small erect columns, grouped eight to ten together on a common stroma, somewhat resembling, when seen under the microscope, small crystals. These sporodochia, of a pale pink colour, contained falcate, sometimes spindle-shaped, spores, 30 to 50 by 4 to 5 μ in diameter. The container with this culture was exposed to strong sunlight, and a

few days later the sporodochia took on a bright orange colour which became dark orange subsequently. At first the sporodochia were of a loose consistency, but they hardened with time, becoming waxy and finally horny. The remarkable feature was that transfers from this culture to beer wort agar, on which the original strain failed to produce sporodochia, continued to yield these fructifications, an indication, in the author's opinion, that the chloride of lime had a stimulating effect on the fungus, enhancing its vigour.

Dorogin (G. N.). К фитопатологической экспертизе семян. [On the phytopathological survey of seeds.]—*La Défense des Plantes*, Leningrad, ii, 2, p. 91, 1 pl., 1925. [Received March, 1926.]

This brief note forms a supplement to the author's instructions for the survey of seeds already noticed from another source [see this *Review*, iii, p. 221], the chief purpose of which is to stress the necessity for uniformity in the methods adopted by the various Plant Protection Stations in Russia, and also in the reports issued by them. In the appended plate illustrations are given of the principal fungal spores and mycelia occurring on cereal crops in European Russia, and also brief instructions for grading samples of cereal seeds in regard to their admissibility for sowing purposes.

Jaczewski (A. A.). Международная Ассоциация Организаций по Защите Растений. (Доклад Пятому Всероссийскому Энтомо-Фитопатологическому Совещанию.) [International Association of Organizations for the Protection of Plants. (Report of the Fifth All-Russian Entomo-Phytopathological Congress.)] —*La Défense des Plantes*, Leningrad, ii, 3, pp. 172–175, 1925. [Received March, 1926.]

This is the report to the Fifth All-Russian Entomo-Phytopathological Congress of a proposition introduced by the International Committee of Phytopathology and Economic Entomology to create an International Association of Organizations for the Protection of Plants, reproducing the projected statutes of the Association. After communicating the report, the writer moved the following resolutions. (1) Realizing the great practical importance of an international agreement concerning phytopathology and applied (economic) zoology, the Congress expresses the desire that all institutions dealing with phytopathology and entomology in Russia, should join the Association. (2) The Permanent Bureau of the Congress is requested to find the funds necessary for that purpose. (3) The Permanent Bureau is entrusted with the compilation of the list of the Russian institutions that intend joining the Association. (4) Six Russian representatives and three substitutes authorized to take part in the meetings of the Association, and more particularly in the constituent meeting projected to take place in 1927, should be elected.

Laubert (R.). **Haben die Schmarotzerpilze der Pflanzen natürliche Feinde?** [Have the fungus parasites of plants any natural enemies?]—*Gartenwelt*, xxix, 52, pp. 858–859, 1925.

A few instances of the attack of fungus parasites of plants by their natural enemies are briefly enumerated. The uredospores of

the rusts occurring on various plants are frequently partially or totally destroyed by a mite (*Mycodiplosis* sp.), while a closely related insect attacks the mildews [Erysiphaceae]. The rusts also suffer from the ravages of *Darluca* spp. (especially *D. filum*) and the mildews from those of *Cicinnobolus* spp. (especially *C. cesatii*). *Peridermium pini* and *P. strobi* are liable to attack by *Tuberculina maxima*, while *T. persicina* parasitizes other rusts. A bright red species of *Fusarium* may sometimes be observed in autumn on ergot [*Claviceps purpurea*].

The possibility of utilizing these natural enemies in the control of parasitic fungi is briefly discussed.

FERNOW (K. H.). **Interspecific transmission of mosaic diseases of plants.**—*Cornell Agric. Exper. Stat. Mem.* 96, 34 pp., 7 pl., 1925. [Received March, 1926.]

A series of investigations was carried out at Cornell University (United States) from 1922 to 1924 to elucidate various problems in connexion with mosaic diseases of plants.

The sources of inoculum from which the material used in the work was obtained were as follows. (1) Mosaic tobacco plants. (2) Mosaic potato plants, including a number representing the types of mosaic described by Schultz and Folsom [see this *Review*, iii, p. 548]. (3) Mosaic *Datura stramonium* plants. (4) Mosaic *Nicotiana glutinosa* plants which developed the disease after inoculation with the juice of infected *D. stramonium*. (5) Mosaic *Phytolacca decandra* plants. (6) Mosaic *Rumex obtusifolius* plants. (7) Mosaic bean (*Phaseolus vulgaris*) plants grown from infected seed. (8) Mosaic *Echinocystis lobata* plants.

Various methods of inoculation were used, namely, rubbing with crushed leaf tissue, inserting crushed leaf tissue into split stems, and grafting. Brief particulars are given of the technique used in the experiments [the results of which are presented in tabular form].

It was observed that the same host may be attacked by more than one mosaic, each of which may produce different symptoms. Thus *N. glutinosa* is susceptible to the mosaics from potato, *N. glutinosa*, and *E. lobata*, the last-named causing the most pronounced symptoms, which resemble those of the ordinary tobacco mosaic. On *N. rustica* the mosaic of tobacco produces a yellow discoloration of the foliage, the death of the terminal bud and younger leaves, and a necrotic spotting of the interior of the stem.

Potato plants inoculated, by grafting, with tobacco mosaic exhibit a yellow (later brown) spotting of the leaves and a severe necrotic streaking of the petioles and young stems, generally followed by the death of the affected shoots. The second generation plants are usually much dwarfed and the leaves show one to five yellowish spots, which frequently develop before the full expansion of the leaf, thereby precluding growth and causing a puckered appearance. The necrotic streaking of the petioles and stems is often more severe than in the first generation plants, the older leaves dropping prematurely. These symptoms closely resemble those of streak [loc. cit.].

The same type of mosaic disease resulted whenever potatoes were used as a source of inoculum on suitable hosts, irrespective of

whether the plants employed showed symptoms of mild, leaf rolling, or rugose mosaic [loc. cit.] or some other virus disease. Later the same symptoms (a fine mottling with little distortion) were obtained when apparently healthy potatoes were used as sources of inoculum [see this *Review*, v, p. 119]. It would seem, therefore, that the differing symptoms of the various types of potato mosaics mentioned are not due to the most prevalent potato mosaic virus, which causes no visible symptoms on potato and may be considered to be a masked virus, producing little effect on the yield (and therefore not liable to be eliminated but rather to become universal), but to other viruses, at least three of which have been recognized.

Inoculation tests with the juice of potato plants infected by tobacco mosaic almost invariably gave positive results on *Nicotiana glutinosa* and *Nicandra physaloides*, although it was found impossible to secure infection on these hosts with tobacco mosaic from any other plant. Positive results were obtained also in inoculation tests made with supposedly healthy potatoes. This may be taken to support the suggestion of a masked potato virus which, rather than the tobacco virus, was transmitted in the first case.

D'Hérelle (F.) & Hauduroy (P.). **Sur les caractères des symbioses 'bactérie-bactériophage'.** [On the characters of symbioses between bacteria and the bacteriophage.]—*Comptes Rendus Soc. de Biol.*, xciii, 34, pp. 1288–1290, 1925.

It has been shown in previous communications by the writers that filtrates of bacterial emulsions of the organisms on which they have studied the action of the bacteriophage [see this *Review*, v, pp. 239–245] resume their original turbidity after periods ranging from a few days to some weeks. This phenomenon is ascribed to the passage through the filter of infra-visible bacterial forms. These secondary cultures obtained after filtration necessarily contain bacteriophagous corpuscles and resistant bacteria. When the virulence of the bacteriophage is slight, such secondary cultures are of frequent and rapid occurrence, and the resistant bacteria differ but little morphologically from normal bacteria of the same species. On the other hand, when the bacteriophage possesses a high degree of virulence, secondary cultures are rare and are not formed for several days or weeks after filtration. Most of the coccus-shaped granules, 2 to 3 μ in diameter, composing these cultures are Gram-negative, even when the original species, e.g., *Staphylococcus*, is Gram-positive. When transferred to plain bouillon, these secondary cultures often remain sterile or develop slowly, whereas rapid growth occurs on albuminous media, such as bouillon-serum. The cultures may then either gradually return to the normal character of the species, or persist indefinitely in the granular form. This latter case is considered to represent a state of perfect symbiosis between the bacterium and the bacteriophage. Identical results have been obtained in secondary cultures (developing after filtration or otherwise) of *Bacillus coli*, *B. dysenteriae* (Shiga and Hiss), *B. typhosus*, *B. pestis*, *Staphylococcus albus*, and *S. aureus*. The symbiotic cultures are stated to be morphologically indistinguishable whatever their origin.

The viability of these symbiotic cultures is striking. Whereas the life of *B. dysenteriae* Shiga does not exceed a few weeks in

bouillon, a culture of this organism in association with the bacteriophage has given subcultures after nearly ten years in sealed tubes.

These facts are regarded as affording an explanation of the recrudescence of certain infectious diseases of obscure origin.

FERDINANDSEN (C.) & WINGE (Ö.). **Cenococcum Fr. A monographic study.**—*Kgl. Vet. og Landbohøjskole Aarsskr.*, pp. 332–382, 17 figs., 1925. [Received March, 1926.]

For several years past the writers have made a study at Lyngby, Denmark, of the fungus *Cenococcum graniforme* (Sowerby) Ferd. & Winge nov. comb. (*C. geophilum* Fr.), which occurs throughout a large part of Europe in the upper layers of raw humus in woods, and in moor, heath, and bog soils. Hitherto our knowledge of the nature of the small, black, brittle, generally hollow bodies, often resembling shot, of which the fungus is composed has been very incomplete, but the writers claim to have shown by their investigations [which are fully described] that the organism is a *Sclerotium* forming no spores, but only sclerotia and a more or less well-developed mycelium penetrating the substratum.

Dead birch mycorrhiza, up to 1 cm. in length, completely encrusted by the sclerotial tissue of *Cenococcum*, have occasionally been found in the upper layer of humus. This suggests the possibility that the fungus may sometimes form an association with living tree roots, either accessorily in the mycorrhiza sheath or otherwise. It is evident that a practically ubiquitous fungus of this type must play a considerable part in the transformation of organic material in humus soil.

The synonymy of the fungus is fully discussed, and a bibliography of 44 titles is appended.

MAGROU (J.). **La symbiose chez les Hépatiques. Le 'Pellia epiphylla' et son champignon commensal.** [Symbiosis in Liverworts. *Pellia epiphylla* and its symbiotic fungus.]—*Ann. Sci. Nat.*, 10e Sér., vii, 5–6, pp. 725–778, 15 figs., 1925.

This is a detailed report of the author's investigation of the mutual relationship of the liverwort *Pellia epiphylla* and the endogenous fungus normally harboured by it. In his observations the fungus was always abundantly present in the old, brown fronds of the host that had ceased to produce spores, while in the younger, bright green fronds bearing archegonia or sporogonia at various stages of development, the infestation was much more limited. In the few cases of extensive invasion of such shoots by the fungus, the mycelium was in a degenerating condition in the vicinity of the fruiting organs, which appeared to have an inhibiting effect on its development, since as soon as these organs ceased to function and withered, the fungus resumed its progress. In its morphological features, which are briefly described, the fungus is entirely analogous to the mycorrhizal endophytes of the type bearing vesicles and arbuscles [see this *Review*, iv, p. 301].

When sown under laboratory conditions, in unsterilized earth taken from places where the plant occurs naturally, the liverwort germinated readily and gave rise to gametophytes that were found to be affected by the fungus at a very early stage of their development. The endophyte gradually invaded the whole of the median

vein of the frond, with the exception of the apical meristem. The chloroplasts in the invaded cells were digested, and the tissues turned brown and decayed, a new shoot arising, after a time, from the apical meristem. When sown in sterilized earth or in synthetic media with a neutral reaction, the germination of the *Pellia* spores was scanty and irregular, and the seedlings soon perished after a very poor growth; in acid synthetic media with the same P_H value (4·85) as that of the soil where the liverworts grew in nature, however, germination was good, and the seedlings thus raised grew rapidly and attained larger dimensions than those grown in unsterilized earth. It would, therefore, appear that the effect of the symbiotic fungus is to produce alternate spurts of growth and of rest in the gametophyte of *Pellia*, and this is said to be comparable with the effect of fungal symbiosis on the development of the sporophyte in certain vascular plants.

HEUKELEKIAN (H.) & WAKSMAN (S. A.). **Carbon and nitrogen transformations in the decomposition of cellulose by filamentous fungi.**—*Journ. Biol. Chem.*, lxvi, 1, pp. 323–342, 1925.

The carbon and nitrogen transformations in the decomposition of cellulose by two typical soil fungi, *Trichoderma koningi* and *Penicillium* sp., have been studied [see also this *Review*, iv, p. 240].

The technique of the experiments is described, and the results are presented in tabular form besides being fully discussed in the text. Cellulose was used in the form of filter paper, 1 per cent. of which was added to the culture medium (a synthetic solution, sand, or soil) in each of the tests. The 300 c.c. flasks of sterilized media were inoculated with a loopful of spore material from a recently transplanted culture, and connected in the incubator at 25° to 28° C. to a special respiration apparatus for the measurement of carbon dioxide. The methods of determination of the metabolic products formed during the incubation period (14 to 38 days) are briefly described.

The results of the five experiments discussed in this paper are regarded as pointing definitely to the conclusion that, in the decomposition of cellulose by the two fungi studied, carbon dioxide and fungus mycelium are the only end-products formed, no intermediate and no other final products being left in the medium. These fungi utilize the cellulose as a source of energy for the synthesis of their own protoplasm. A part of the carbon contained in the cellulose is reassimilated, while the remainder is given off as CO_2. The relationship between these two products varies with the age of the organisms, a greater proportionate degree of assimilation being indicated in the earlier stages. The nitrogen transformation by the organism results from that of the carbon: a definite correlation was found between the amount of carbon assimilated and the quantity of nitrogen required for the synthesis of the fungus. At the earlier stages of growth the protoplasm contains a higher percentage of nitrogen, and thus decomposes less cellulose per unit of nitrogen assimilated. During active growth, the percentage of nitrogen in the protoplasm falls, thus enabling the fungus to decompose larger amounts of cellulose per unit of nitrogen assimilated. On the termination of active growth, autolysis begins, with a consequent rise in the percentage of nitrogen in the mycelium, due

largely to the decomposition of the carbonaceous reserve products of the protoplasm.

In the decomposition of cellulose by fungi, therefore, the only residual product left is the fungus protoplasm. This has an important bearing, not only on the decomposition of cellulose in the soil, but also on the transformation of nitrogen, resulting as it does in the storing away of considerable quantities of the latter in an unavailable form, in direct proportion to the amount of cellulose available. It also bears directly on the formation of humus in the soil. In normal soils the synthesized fungus mycelium will be further decomposed by other micro-organisms, resulting in the liberation of available nitrogen.

SCHULTZ (E. S.). **A Potato necrosis resulting from cross-inoculation between apparently healthy plants.**—*Science*, N.S., lxii, 1616, pp. 571–572, 1925.

During the winter of 1923–4 the writer observed a necrosis of certain potato seedlings which were undergoing investigation in the Washington greenhouses. The symptoms of these necrotic seedlings resembled those of streak [see this *Review*, ii, p. 285; iv, p. 563]. Necrosis developed on certain seedling varieties as a result of tuber grafts on Green Mountain potatoes affected with mild mosaic and spindle tuber [see this *Review*, iv, p. 692], while other seedlings of different parentage, and other varieties, similarly treated, manifested only mild mosaic and spindle tuber symptoms, as also did the shoots from the Green Mountain parts of the grafted tubers. All the controls from seed pieces from the same tubers as the grafted healthy seed pieces remained healthy.

Necrosis again developed on the same seedlings and one other during the autumn of 1924, when studies were also initiated on the reaction of some apparently healthy foreign varieties, namely, Duke of York, Bravo, Paul Kruger [President], Koksiaan [Jersey Nonsuch], and Arran Comrade to the mosaic, leaf roll, and spindle tuber diseases in Green Mountains. Necrosis developed on these varieties when grafted on mosaic, leaf roll, and spindle tuber Green Mountains. Some of the shoots became necrotic when only a few centimetres above the ground, without manifesting the symptoms of the particular disease shown by the Green Mountain used in the graft, while others plainly revealed mosaic, leaf roll, or spindle tuber, as the case might be. Control plants grown from seed pieces from the same tuber as the grafted healthy parts remained healthy. Furthermore, no necrosis appeared on the shoots from the mild mosaic, spindle tuber, or leaf roll Green Mountain tubers. In a similar series of mild mosaic Green Mountain tuber grafts on healthy Green Mountains, Rural New Yorkers, Irish Cobblers, Spaulding Rose, Early Rose, and Bliss Triumph, no necrotic symptoms were observed.

Tuber grafts were then made between apparently healthy Green Mountains and healthy Duke of York and Paul Kruger, and between healthy Bliss Triumph and Paul Kruger. Necrosis developed only on Duke of York and Paul Kruger within thirty days of grafting and planting, some of the shoots revealing symptoms very shortly after emergence from the soil, while others were 30 cm, or more in height before any signs of disease appeared.

Similarly, scions from apparently healthy Green Mountains on healthy Paul Kruger and Bravo produced necrosis in the axillary shoots of the stock. Healthy Paul Kruger and Bravo scions on healthy Green Mountains developed necrosis on the scions only.

Necrosis also developed from juice inoculations by leaf mutilation between apparently healthy Green Mountains and the susceptible apparently healthy potato varieties and seedlings. Tuber grafts between apparently healthy Irish Cobbler, Russett, Rural New Yorker, Rose 4, or Bliss Triumph on the one hand and certain potato seedlings on the other resulted in necrosis of the latter only. Juice inoculation from such necrotic seedlings on apparently healthy ones produced necrosis on the latter, the controls remaining uniformly healthy.

No mottling as described by Johnson in his cross-inoculations between healthy potato and tobacco [see this *Review*, v, p. 119; and above, p. 315] was observed in these investigations.

It has been shown that in certain virus diseases of plants and animals the infective principle may be transmitted by apparently healthy individuals, and probably such conditions obtained in the investigations described above. It would seem that the necrosis in question is distinct from streak.

De Vilmorin (H. L.). **Notes sur quelques variétés de Pommes de terre résistantes à la maladie verruqueuse.** [Notes on some varieties of Potato resistant to wart disease.]—*Journ. d'Agric. Prat.*, lxxxix, 49, pp. 153–154; 50, pp. 475–478; and 51, pp. 493–496, 1925.

In connexion with the publication of Foëx's treatise on wart disease of potatoes [*Synchytrium endobioticum*: see this *Review*, v, p. 181], the writer describes the result of investigations, carried out since 1920 at Verrières-le-Buisson (Seine-et-Oise), on the adaptability of recognized resistant British, German, and Dutch varieties to cultivation under French conditions. Among the most promising foreign varieties may be mentioned the following: (1) British: Barley Bounty (also resistant to virus diseases), Bishop, Crusader, Dargill Early (or Boston Kidney), Great Scot, Majestic, and White City. (2) German: Juli, Pepo, and Ursus (a variety of Polish origin which passes for highly resistant to wart disease in Germany, but was adjudged susceptible, under the name of Grosse du Gâtinais, at recent Ormskirk trials). (3) Dutch: Favoriet, Industrie rouge, and Robyn, all of which showed remarkable resistance to *Phytophthora* [*infestans*] in 1925.

Among the French varieties which have shown a high degree of resistance to wart disease in the Ormskirk trials since 1920 may be mentioned Belle de Juillet (Juli), Pousse debout, Quarantaine de la Halle, and Quarantaine violette.

In conclusion a list is given of the varieties recommended for French cultivation, classified according to precocity, while indications are furnished in certain cases as to their suitability for development on a large scale.

Departmental activities. Wart disease in Potatoes.—*Journ. Dept. Agric. S. Africa*, xii, 1, p. 11, 1926.

In recording an outbreak of potato wart disease (*Synchytrium*

endobioticum) in some small allotments in the neighbourhood of Johannesburg at the end of 1925, the statement is made that the disease had been noticed earlier during the same year, but not reported to the authorities, by one of the occupiers. The failure of notification led to an alarming extension of the disease during the present season. This outbreak is considered to be of a far more serious nature than the only other South African attack, which occurred in Natal in 1922 [see this *Review*, iii, p. 382], the danger being enhanced by the fact that the focus of infection is in a populous area where potatoes are grown for the market and infection may be spread through soil adhering to the boots of persons walking from one place to another.

Quarantine on account of the flag smut disease. Notice of quarantine No. 59.—*U.S. Dept. of Agric. Fed. Hort. Board, Leaflet*, 1 p., 1925.

Quarantine No. 59 of the Federal Horticultural Board of the United States Department of Agriculture, effective on and after 1st February 1926, prohibits the importation into the United States from India, Japan, China, Australia, South Africa, Italy, and Spain of all species and varieties of wheat and wheat products, except such as have been milled or so processed as to have destroyed all flag smut (*Urocystis tritici*) spores. This quarantine supersedes No. 39, which has been in effect since 15th August, 1919, with the result that such restrictions on wheat importations as are now in force on account of the take-all disease of wheat [*Ophiobolus graminis*] are removed. The widespread distribution of take-all in the United States and Canada seems amply to justify the repeal of the quarantine order covering that disease.

Modification of nursery stock, plant and seed quarantine regulations. Amendment No. 4 of revised rules and regulations supplemental to notice of quarantine No. 37.—*U.S. Dept. of Agric. Fed. Hort. Board, Leaflet*, 1 p., 1925.

Regulation No. 3 of the revised rules and regulations supplemental to notice of quarantine No. 37, governing the importation of nursery stock, plants, and seeds into the United States, which came into effect on 5th April, 1923, is amended as from 1st January, 1926, as follows. The importation from contiguous countries, which maintain inspection, of the following categories of nursery stock and seeds may be authorized under permit upon compliance with the regulations in force.

Bulbs of *Lilium, Convallaria, Hyacinthus, Crocus*; and until further notice, of *Chionodoxa, Galanthus, Scilla, Fritillaria imperialis, F. meleagris, Muscari, Ixia, and Eranthis*. Stocks, cuttings, scions, and buds of fruit trees, rose stocks, and nuts (including palm seeds) for propagation. Seeds of fruit, forest, ornamental, and shade trees, of deciduous and evergreen ornamental shrubs, and of hardy perennial plants.

The importation of the above from countries not maintaining inspection is also permissible, upon compliance with the regulations, but should be limited to experimental material only, except in the case of tree seeds.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

VOL. V JUNE 1926

REISS (P.). **Données physico-chimiques sur une tumeur végétale infectieuse.** [Physico-chemical data on an infectious plant tumour.]—*Comptes Rendus Soc. de Biol.*, xciii, 35, pp. 1371–1373, 1925.

During 1925 a serious outbreak of wart disease of potatoes (*Synchytrium endobioticum*) occurred in the valley of the Bruche [Vosges Mountains].

In order to determine the hydrogen-ion concentration of the warted tissues, one of the warts was peeled, ground, and mixed with twice its volume of water. After ten minutes the hydrogen-ion concentration was found to be P_H 5·85 compared with P_H 6·21 for the normal tuber. In another case, in which the expressed juice of the tumour was immediately tested, its P_H value was 5·59 against 6·01.

The isoelectric points were approximately 5 for the infected subcortical cells and 6·5 for the deeper parts of the wart as well as for the normal tuber. In these underlying regions of the tumour the adult cells are stated to be barely distinguishable from the normal, and the approximation in the isoelectric points is a mark of this similarity. The subcortical cells, with their low isoelectric point, form the starting-point of the neoplasm. In all the centres of fresh growth, even those remote from the diseased cells, the isoelectric point is also low.

These data suggest that at a certain stage in the development of the fungus the isoelectric point of the infected cells or adjacent elements must have sunk below the hydrogen-ion concentration of the tissue. In these conditions, according to Loeb, the viscosity and other physico-chemical properties of the protoplasm are at their lowest ebb. Cellular proliferation appears, indeed, to be strikingly facilitated, if not actually stimulated, near the isoelectric point. Possibly, therefore, the physico-chemical modifications of the protoplasm in proximity to the fungus give rise to the cellular division which results in tumour formation. Histologically, the onset of proliferation is localized in the region of the infected cells.

KOTILA (J. E.) & COONS (G. H.). **Potato spraying and dusting experiments in Michigan.**—*Michigan Agric. Exper. Stat. Techn. Bull.* 72, 15 pp., 2 figs., 1 graph, 1925. [Received March, 1926.]

The results of three years' experiments in the comparative value of spraying and dusting potatoes in Michigan are discussed and presented in tabular form. In one season (1922) hopperburn was very severe, and both Bordeaux mixture (4–4–50) and copper lime dust (Niagara Potato Dust D 20 and D 6) at the rate of 50 lb. per acre gave increased yields. The high cost of the dust, however, precludes its use on a large scale. The estimated increase in the plots treated with Bordeaux mixture was approximately 74 bushels per acre, representing a profit of $22·12 per acre.

In the two following years fungous diseases and insect pests caused little or no damage, and the treated plots were not markedly superior to the controls. No stimulatory effect apart from disease control was observed.

The continuance of the standard practice of spraying with Bordeaux mixture is advised.

ROSE (R. C.). **Treating seed Potatoes with hot formaldehyde.**—*Minnesota Agric. Ext. Div. Spec. Circ.* 22, 3 pp., 2 figs., 1925.

The hot formaldehyde treatment of seed potatoes as a preventive of the three diseases *Rhizoctonia* [*solani*], scab [*Actinomyces scabies*], and blackleg [*Bacillus atrosepticus*] is considered to be superior to cold formaldehyde or corrosive sublimate. Its economic advantages are that it is non-poisonous, quick (only two minutes being required for soaking), causes no corrosion of metal, and the same solution can be used indefinitely if replenished when necessary.

In the steam heating method the water in a tank is heated by steam, let into it from a boiler, to 120° F., and kept between 118° and 120° during the operations. One pint of commercial formaldehyde is added to each 15 galls. water and the potatoes are immersed for two minutes. After each 50 bushels of potatoes are treated, the solution should be replenished with nine-tenths of a pint of formalin, to allow for that removed in the tubers and the increased dilution resulting from condensed steam. The treated potatoes should be covered in a pile for one hour following treatment, then allowed to dry, and planted as soon as possible.

When steam is not available a fire trench can be dug under the tank and the heat regulated sufficiently for the purpose by using a six-foot stove pipe with a damper at one end of the trench. A false bottom is required in this method to prevent the lowest potatoes from being overheated. Replenishing in this case should be done with formalin of the same strength (1 pint to 15 galls.) as the original solution.

WRIGHT (C. H.). **The modern aspects of disease control.**—*India-Rubber Journ.*, lxx, 13a, pp. 40–43; 18, pp. 15–16; and 19, pp. 17–19, 1925.

In connexion with a general discussion on various aspects of disease control in rubber plantations, the writer cites some interesting statistics of root diseases. During the period 1924–5, 1,790

trees on a property of 2,000 acres in Sumatra were attacked by different species of *Fomes*, *Poria hypobrunnea*, and *Ustulina zonata*; of these 750 were cured and 226 removed. In a Malayan plantation of 1,000 acres, 334 trees had to be eradicated on account of attack by *F. lignosus*, *F. pseudoferreus*, *U. zonata*, and *Sphaerostilbe repens*. Other records from 2,000-acre properties show losses of 5,529 trees from *Fomes* and 344 from *Poria*. The symptoms of root diseases are briefly described, control measures are indicated, and future policy discussed with special reference to the necessity for thorough sanitation and preventive treatment.

The second part of this paper deals with stem and branch diseases. The following records have been obtained of the diseases occurring on three properties in Sumatra in 1924. On a plantation comprising nearly 3,000 acres with a stand of over 255,000 trees, black stripe (*Phytophthora* sp.) affected 3,718 new cases, whilst 3,669 (old and new) were cured; pink disease (*Corticium salmonicolor*) was found on 6,147, whilst 4,152 were cured; and brown bast on 2,539, whilst 402 were cured and 8 removed. On a plantation of 5,000 acres with 418,924 trees, brown bast affected 2,381 fresh individuals; 2,603 cases (old and new) were cured and 74 removed. On a property of 2,000 acres with 168,462 trees, *C. salmonicolor* occurred on 2,393 new cases, whilst 2,484 cases (old and new) were cured; mouldy rot (*Sphaeronema fimbriatum*), black stripe, and patch canker (*P. faberi*) attacked a further 1,652 trees, whilst 1,152 were cured and 15 removed; brown bast affected 3,482 more trees, whilst 3,048 were cured and 21 removed.

The symptoms of these diseases are briefly described and control by means of injection, diffusion of toxic gases, manuring, painting with antiseptics, and excision and tarring methods discussed, only the two last-named being recommended for use on a large scale. The work of Petch on the canker diseases and of Keuchenius on brown bast [see this *Review*, i, p. 263; iv, p. 310] is briefly outlined.

Notes are given on the leaf diseases caused by *Phyllosticta ramicola*, *Gloeosporium albo-rubrum*, and *Phytophthora* sp., and on the control of nursery diseases (*Pestalozzia palmarum* and die-back).

[This paper has been reprinted in part in *Trop. Agriculturist*, lxvi, 1, pp. 30–38, 1926.]

Rubber production in the Amazon Valley. Report by the Crude Rubber Survey.—*India-Rubber Journ.*, lxx, 22, pp. 13–20, 1925.

In the section of this paper relating to fungous diseases of rubber in the Amazon Valley, it is stated that the fructifications of *Fomes* and other wood-destroying fungi are abundant in the jungle, while effects resembling those produced by *Poria* [*hypobrunnea*] and *Ustulina* [*zonata*] are common. No pink disease (*Corticium salmonicolor*) has been observed. A virulent form of cambium rot is reported to attack the cortex of trees tapped according to eastern methods, and it is thought that the organism involved in this disturbance may also be responsible for the condition known as 'virgin scrap', characterized by the appearance of diseased areas at any place on the base of the tree and a constant exudation of latex, resulting in the formation of masses of rubber (up to 200 lb.)

between the bark and wood and round the wood. The latter is covered with oxidized rubber, which also hangs on the bark below. The wood shows a superficial brown discoloration, and both the bark and the rubber emit a disagreeable putrid odour.

Dothidella [*Melanopsammopsis*] *ulei*, the leaf disease caused by which has completely ruined the rubber industry of British and Dutch Guiana [see this *Review*, iv, p. 309], is known to exist in the basin of the Amazon, but so far no estimate can be made of its probable importance. On native forest *Hevea* trees its effects are not very pronounced. Another host of *M. ulei* is *Hevea guyanensis*. The most conspicuous of the other leaf diseases is that caused by the fungus *Catacauma huberi*, which produces round, hard, black blotches on the under side, followed by the desiccation, red discoloration, and falling of the leaves. The disease may affect one tree while its neighbours remain completely healthy. This fungus is very prevalent in the delta and island regions.

WRIGHT (C. H.). **Leaf diseases of Hevea.**—*India-Rubber Journ.*, lxx, 23, pp. 15–17; 26, pp. 15–17, 1925.

The principal leaf diseases of rubber in (*a*) South America and (*b*) the East are enumerated as follows: (*a*) *Catacauma huberi* [see preceding abstract]; *Fusicladium macrosporium* [*Melanopsammopsis ulei*]; and *Scolecotrichum heveae*. (*b*) *Phytophthora faberi* and *P. meadii* [see next abstract]; *Gloeosporium albo-rubrum* [see this *Review*, iv, p. 239]; *Oidium* [*heveae*: see this *Review*, iv, p. 702]; *Helminthosporium heveae* [see this *Review*, iii, p. 300]; *Phyllosticta heveae*; *Ascochyta heveae*; *Guignardia heveae*; sooty moulds (*Meliola*, *Chaetopeltopsis*); thread blight; horsehair blight [*Marasmius equicrinis*]; and *Cephaleuros parasiticus*.

The symptoms of the diseases are described in general terms, and some observations are made on their importance, the conditions favouring their development, and their control by sanitation and cultural measures.

The question of spraying is dealt with at some length, and suggestions are made for the testing of certain new compounds. Directions are given for the preparation of various fungicides, including Bordeaux, Burgundy, Woburn-Bordeaux, and carbide-Bordeaux mixtures (the first- and last-named being regarded as probably the most generally efficacious). The use of spreaders is briefly discussed, the addition of 2 lb. rosin, casein, or soft soap to 50 galls. of mixture being recommended. The concluding section of the paper is devoted to remarks on the technique of spraying and on the introduction of spraying batteries for general use. [This paper has been reprinted in *Trop. Agriculturist*, lxvi, 2, pp. 90–100, 1926.]

SHARPLES (A.). **Diseases of Hevea.**—*India-Rubber Journ.*, lxxi, 7, p. 4, 1926.

Attention is drawn to a statement in Wright's paper on leaf diseases of rubber [see preceding abstract] which might give rise to a misconception as regards the situation in Malaya. In the above-mentioned article black stripe is referred to *Phytophthora meadii* and patch canker to *P. faberi*. In Malaya the former disease is caused

by a species of *Phytophthora* allied to, but distinct from, *P. faberi* [see this *Review*, v, p. 5], while the latter is due to an organism which should perhaps be referred to the genus *Pythium* [see this *Review*, iv, p. 702]. So far there has been no record of *Phytophthora* pod rot and leaf fall in Malaya.

Wright's suggestions for an extended spraying campaign are fully endorsed.

SHARPLES (A.). **Note on Sphaeronema fimbriatum.**—*Malayan Agric. Journ.*, xiii, 12, p. 399, 1925.

Attention is called to the statement by A. J. Elliott (*Phytopath.*, xiii, p. 56, 1923) [and xv, p. 417, 1925] that the supposed pycnidia of *Sphaeronema fimbriatum*, the cause of sweet potato black rot and mouldy rot of rubber [see this *Review*, v, p. 184], are really perithecia and that the organism should consequently be known as *Ceratostomella fimbriata*.

SOFONEA-DRĂGUȘ (S.). **Thielavia basicola Zopf găsită pe Hyoscyamus niger L.** [Discovery of *Thielavia basicola* Zopf on *Hyoscyamus niger* L.]—*Buletinul de Informații* [Cluj], v, 3–4, pp. 124–127, 1925. [French translation. Received March, 1926.]

This brief note is the first record, so far as the author is aware, of *Thielavia basicola* parasitizing henbane (*Hyoscyamus niger*). The outbreak occurred in 1925 in a plot of henbane volunteers at the Medicinal Plants Experiment Station of Cluj [Rumania]. The symptoms, which were noticed in May, consisted of stunted growth, crinkled foliage of a paler colour than normal, reduced bushiness of the aerial parts, and a rot of the cortical tissues of the roots. Out of 565 plants in the plot only 70 survived long enough to bear seed, the germinability of which was not tested. Examination of the diseased roots showed that the cortex was permeated by a mycelium bearing conidiophores with endoconidia, and others with brown or occasionally hyaline chlamydospores, in chains of up to 8 spores. Perithecia were not found.

LEE (H. A.). **Evidence of a factor associated with actively functioning tissues which gives to Sugar-cane plants resistance to the invasion of fungi and other micro-organisms.** —*Journ. Gen. Physiol.*, ix, 3, pp. 381–386, 1 fig., 1 diag., 1926.

Sugar-canes in Hawaii are stated to be attacked by a disease known as Pahala blight [see next abstract], in some phases of which the aerial shoot seems incapable of forming its own roots and feeds through the seed cutting. In certain cases examined the latter did not succumb to the soil fungi which usually invade it. Healthy stools adjacent to the infected canes, however, developed roots from their aerial shoots, and when this occurred the seed cuttings were infected by micro-organisms, the tissues were entirely rotted, and the cuttings no longer assisted in the development of the aerial shoot. Such observations were uniform on twenty or thirty diseased and healthy canes.

At the time of these observations a study was in progress at the

Experiment Station of the Hawaiian Sugar Planters' Association on the function of the roots from the nodes of seed cuttings in connexion with the growth of aerial shoots. In potted cane plants the aerial shoots were kept free from soil, and all roots except those from the cutting were pruned off as they developed, so that the shoots were forced to draw their mineral supply through the roots from the nodes of the sett. After six months it was found that the aerial growth in the plants so treated was quite as satisfactory as in those grown under normal conditions. Moreover, all the plants that fed through the seed cutting remained free from infection by fungi and other organisms, while in the controls the seed cuttings were entirely decayed.

It would appear from these data that there are one or more factors in actively functioning sugar-cane tissues which confer upon the latter resistance to infection by soil micro-organisms. Such resistance may be due to a simple physical factor, such as the greater turgor of the actively functioning cells. Another explanation (at present purely conjectural) may be based on the formation by the aerial shoots of substances which normally flow to the roots and enable them to resist fungus invasion; when the normal roots from the aerial shoots are inhibited, this hypothetical substance may, in its passage to or through the seed cutting, contribute to its resistance.

B[ARBER] (C. A.). **The Sugar Experiment Station in Hawaii. The record of 1924 and 1925.**—*Intern. Sugar Journ.*, xxviii, 325, pp. 13–18, 1926.

In this summary of recent progress at the Hawaii Sugar Experiment Station, based on the reports of the Director, Mr. A. P. Agee, the following notes on phytopathological work (pp. 15–16) are of interest.

The D 1135 variety appears to be relatively resistant to Pahala blight [see preceding abstract] which for many years has not been amenable to control measures, though experimental plots treated with flowers of sulphur spread on the soil remained free from the disease and made twice the growth of those untreated. Chlorotic canes treated with ferrous sulphate recovered in the same way as pineapples similarly affected [see this *Review*, iii, p. 743]. In the course of investigations on Lahaina disease or root rot [see next abstract] accumulations of sodium chloride and aluminium salts in the soil have been found to interfere with the metabolism of the canes. The D 1135 has been affected by a disturbance due to aluminium toxicity.

McGEORGE (W. T.). **The influence of aluminium, manganese and iron salts upon the growth of Sugar cane, and their relation to the infertility of acid Island soils.**—*Hawaiian Sugar Planters' Assoc. Exper. Stat. Bull.* 49, 95 pp., 1925. [Abs. in *Chem. Abs.*, xix, 22, p. 3558, 1925.]

Salts of aluminium in concentrations present in many acid Hawaiian soils exercise a retarding and often severely toxic action on the growth of sugar-cane [see this *Review*, v, p. 57]. Manganese

salts have no effect on the root growth of sugar-cane in water cultures. The Lahaina variety is more susceptible to aluminium toxicity than D 1135 or H 109. Acidity *per se* or hydrogen-ion concentration of the intensity present in the most acid types of Hawaiian Island soil has no influence upon the growth of sugar-cane apart from the action of aluminium salts. Aluminium toxicity is a direct toxic action and not a P_2O_5 deficiency, though an increase in the P_2O_5 or K_2O reserve of the plant may strengthen its resistance. Cane plants grown on acid soil containing soluble iron and aluminium are characterized by abnormal accumulations of these elements at the nodal joints of the stalk. Acid Island soils containing soluble aluminium will respond markedly to soluble P_2O_5 applications. The P_2O_5 is rapidly fixed and only effective over a short period. There is also a marked response to heavy K_2O applications, but not always to ordinary amounts. CaO gave no immediate response, but there was a greater residual stimulation in plant growth.

These investigations prove that aluminium is a factor directly associated with the retarded growth of sugar-cane on the acid Mauka lands, and that both P_2O_5 and K_2O may exert an influence on plant growth other than as a direct nutrient. It is not suggested that aluminium is the cause of the Lahaina disease [loc. cit.], but rather that it is one of the several factors involved in the low fertility of some Hawaiian sugar-cane plantations.

COTTRELL-DORMER (W.). **Cane pests and diseases.**—*Queensland Agric. Journ.*, xxiv, 5, pp. 441–443, 1925.

Leaf scald [*Bacterium* sp.: see this *Review*, v, p. 188] is stated to be undoubtedly the most serious disease of the Mossman district of Queensland. During the so-called 'wilting stage' of the disease, certain canes, especially of the Clark's Seedling variety, gradually develop dead streaks similar to those caused by gumming disease [*Bact. vascularum*]. The dead leaves of stools killed in this manner are conspicuously dark in colour and much crinkled. Much of the loss due to leaf scald, which in itself is an incurable disease, could probably be avoided by the use of clean seed. No Clark's Seedling within a seven miles' radius of Mossman can safely be used for planting, but there is stated to be an ample supply of good healthy cane round Ferndale and the Upper Mowbray. The seed should be planted in as isolated a position as possible. Similar measures are recommended for the Babinda district, where extremely heavy damage is being caused by leaf scald.

Leaf stripe [*Sclerospora sacchari*] was, in October 1925, in the dormant or leaf-splitting stage in the Mossman district; many of the infected stools were already dead, and only a few of the survivors were severely enough attacked to show splitting, hence the impossibility of forming any estimate of the extent of the disease. Many of the fields which at present show but little trace of infection will probably suffer heavily in the ratoons, especially of the B 147 variety. Leaf stripe appears to be most severe in the Saltwater area, where more fallowing should be practised. The Q 813 variety appears to be resistant.

Foot or root rot, a fungous disease of young plant cane [see this

Review, iv, p. 505], is stated to be causing appreciable damage in the Mossman district, 62 out of 1,000 shoots being affected in one field. In the southern districts this disease appears to be associated with the premature covering of the young cane.

COTTRELL-DORMER (W.). **Cane pests and diseases.**—*Queensland Agric. Journ.*, xxiv, 6, p. 518, 1925.

Leaf scald [*Bacterium* sp.: see last abstract] was observed in a mild form in various localities of the Johnstone River district, Queensland. The heaviest infection occurred in two blocks of the Pompey variety, in which, as in other very susceptible varieties, secondary infection appears to be of great importance. This point was strikingly demonstrated at the South Johnstone Experiment Station, where certain first-stage seedlings, on which no knife or other sharp instrument had been used, were found to be diseased. The nearest infected plants were sometimes as much as 60 ft. distant.

KUYPER (J.). **Het optreden van sereh in maalriet en bibittuinen in 1925.** [The occurrence of sereh disease in Cane fields and nurseries in 1925.]—*Meded. Proefstat. Java Suikerind.*, 11, pp. 375–390, 1925. [Received February, 1926.]

The heavy incidence of sereh disease in Java sugar-cane, especially of the DI 52 variety, during 1925 is attributed mainly to insufficient care in the selection of cuttings, combined with unfavourable weather conditions during the monsoon. The general inferiority of setts from nursery gardens in the plains, as compared with those of mountain origin, is pointed out and supported by statistics which show that, in some cases, in the same plantation setts from the hill nurseries gave from 0 to 1·5 per cent. sereh-diseased plants against 20 to 60 per cent. in those grown from nurseries in the plains. The most rigorous selection is necessary in the case of seed-cane from the plains or of unknown origin.

Incipient sereh disease may frequently be recognized by a grey or reddish discoloration of the stem bases; this, in its turn, is a concomitant of unsuitable soil conditions, which predisposes the cane to the disease.

KUYPER (J.). **Warmwaterbehandeling van bibit tegen sereh.** [Hot water treatment of setts against sereh disease.]—*Arch. voor Suikerind. Nederl.-Indië*, xxxiii, 31, pp. 739–743, 1925.

The current year's experiments in the hot water treatment of sugar-cane setts for the control of sereh disease [see this *Review*, v, p. 4, and next abstract] have brought out various points of interest in connexion with the very divergent results produced by this method. It has been observed that the stimulatory effect induced by immersion in water heated to 52° C. is very beneficial to dry cane, whereas succulent cuttings are weakened to such an extent that decay rapidly sets in, with a consequent heavy reduction in germination. The treated setts should be left to dry for a few days after cutting and should be planted in shallow soil to avoid excessive moisture.

BERG (A. J. J.). **Over den invloed eener warmwaterbehandeling op de kieming van Rietstekken.** [The effect of a hot water treatment on the germination of Cane cuttings.]—*Arch. voor Suikerind. Nederl.-Indië*, xxxiv, 3, pp. 82–89, 1926.

The writer has obtained excellent control of sereh disease of sugar-cane (which he holds to be caused by a deficiency of reducing sugars, associated with an inadequate food supply, in the cuttings) by the hot water treatment [see preceding abstract]. In general, the best results were given by 30 minutes' immersion at 50° to 51° C. for setts of the first and second generation from the nurseries; 30 minutes at 52° for the third to eighth; and 35 to 40 minutes at 52° for the ninth to eleventh. The extremely stimulating effect of the treatment was very noticeable. Thirty minutes' immersion at 51° prevented the spread of pineapple disease [*Thielaviopsis paradoxa*] and the development of moulds where planting was delayed.

ALFARO (J.). **A new method of fighting the propagation of mosaic disease in Sugar Cane.**—*Planter and Sugar Manufacturer*, lxxv, 20, pp. 388–389, 1925.

The writer's investigations on the control of mosaic disease of sugar-cane in Cuba [see also next abstract] have led to the conclusion that insect [aphid] transmission is a much more serious factor in the spread of infection than the use of cuttings from diseased plants for 'seed'. During the inactive stage of the insects (autumn) no transmission occurs, and therefore cane should be planted at this time, instead of in the spring, when the insects begin to emerge and feed on the canes and related plants. Repeated experiments have proved the absolute immunity from mosaic disease, under Cuban conditions, of cold weather canes—that is, those planted in the autumn. [This paper is reprinted in *Trop. Agriculturist*, lxvi, 2, pp. 113–114, 1926.]

RAMOS (R. M.). **Mosaic disease and methods of control.**—*Planter and Sugar Manufacturer*, lxxv, 25, pp. 487–489, 1925.

Statistics are cited in support of the statement that the roguing of spring canes can be adequately carried out in Cuba at a moderate cost, thereby reducing the incidence of mosaic to a minimum, provided the primary infection in the selected seed be less than 10 or 15 per cent. Alfaro's conclusions [see preceding abstract] are stated to rest on a false basis, since the insect vectors of mosaic (*Aphis maidis*) are active during the entire year, and were found by the writer in large numbers on 24th November, 1925, feeding on various grasses.

PRITCHETT (G. H.). **Mosaic disease test at Hacienda Tres Corazones owned by Mr. Manuel Gonzales, Isabela, Occidental Negros.**—*Sugar Centr. and Planters News*, vi, 12, pp. 791–792, 1925.

A test was carried out in the Philippines to determine the effect of ammonium sulphate on Negros Purple canes affected by mosaic disease. The experimental field covered an area of 0·4 hect. divided into eight plots. Eight thousand mosaic 'points' were planted on

four plots, which received an application of ammonium sulphate at the rate of 250 kg. per hect., while the remaining four plots, also planted with 8,000 mosaic cuttings, were left untreated. The canes were planted on 25th January 1924, the fertilizer being applied in the following April, and the crop cut on 13th February 1925. The soil is a heavy loam with good drainage. The yield from the treated plots amounted to 79·8 tons of cane and 137·3 piculs [1 picul = nearly 62 kg.] of sugar per hect., compared with 70·9 and 115·5, respectively, in the controls. It would appear from these data that the application of nitrogen somewhat mitigates the loss of weight which is a normal accompaniment of mosaic disease.

SYDOW (H.). **Fungi in itinere costaricensi collecti.** [Fungi collected on a journey in Costa Rica.]—*Ann. Mycol*, xxiii, 3–6, pp. 308–429, 14 figs., 1925.

The author describes in considerable detail part of the rich collections, mainly of parasitic fungi, made by him in the course of a journey in Costa Rica in 1924–5. Uredinaceae and Phyllachoraceae compose the bulk of the collections so far dealt with. A number of new genera and species are described, and a list of papers dealing with Costa Rican mycology is appended.

FRASER (W. P.) & CONNERS (I. L.). **The Uredinales of the Prairie Provinces of western Canada.**—*Trans. Roy. Soc. Canada*, 3rd Ser., xix, pp. 279–308, 1925.

The rusts of the prairie regions of the Provinces of Manitoba, Saskatchewan, and Alberta, Canada, collected up to date chiefly by the author and his colleagues are enumerated. They comprise 128 species, under each of which are given the synonyms, hosts, localities, and, in some cases, notes on points of biological interest.

JØRSTAD (I.). **The Erysiphaceae of Norway.**—*Norske Videnskaps-Akad., Matem.-Naturvid. Kl. Skr.* 10, 116 pp., 2 graphs, 1925. [Received March, 1926.]

This is stated to be the first attempt at a comprehensive survey of the Erysiphaceae of Norway. Some 1,350 specimens (500 of which were collected by the author) have been examined, and 25 species are recognized; eleven of these comprise a certain number of biological forms, some of which show also slight morphological differences. Salmon's classification has been generally followed, though his varieties have been regarded as distinct species.

Under each species all the known Norwegian hosts are listed, with details of locality and collector's name. Copious notes are also given on their prevalence, economic importance, and other points of interest.

ARNAUD (G.). **Les Astérinées. IV^e Partie. (Etude sur la systématique des champignons Pyrénomycètes).** [Asterineae. 4th part. (Studies on the systematics of Pyrenomycetes.)]—*Ann. Sci. Nat., Bot.* X^e Sér., vii, 5–6, pp. 643–722, 16 pl., 25 figs., 1925.

In the present paper an outline is given of the classification of the Pyrenomycetes, which is a development of that given in the author's work 'Les Astérinées. I.' [*Ann. Ec. Nat. d'Agric., Mont-*

pellier, nouv. sér., xvi, 1918]. This is followed by a detailed account of the Myriangiales and Atichiales, which are regarded as primitive Pyrenomycetes.

As in the previous papers of this series, the species studied are illustrated by a series of excellent plates, besides numerous figures in the text.

LIKHITÉ (V.). **Recherches sur le développement et la biologie de quelques Ascomycètes.** [Researches on the development and biology of some Ascomycetes.]—*Thesis, Strasbourg*, 92 pp., 8 pl., 1925.

The author has studied the development and cytology of *Gnomonia leptostyla*, the conidial stage of which, *Marssonia* [*Marssonina*] *juglandis*, is commonly found on walnut leaves; *G. erythrostoma*, the cause of cherry leaf scorch; *Lophodermium hysterioides*, parasitic on the leaves of *Crataegus*; *Hendersonia foliorum*, found on the dead leaves of oak and *Salix caprea*; and *Ramularia urticae*, parasitic on nettles.

In *G. lep'ostyla*, two types of pycnospores have been obtained in culture, those typical of *M. juglandis* and others of smaller size, very narrow, and continuous, which have previously been named *Cryptosporium nigrum*, *Leptothyrium juglandis*, &c. In *G. erythrostoma* only the latter type has been found. *Hendersonia foliorum* has both kinds, which may develop in separate pycnidia or be mingled in the same cavity. In this case the contrast between the large, dark, pluriseptate macroconidia and the filiform, hyaline, unseptate microconidia is very marked. The author does not accept the view that these smaller pycnospores are spermatia, but regards them as belonging to the category of scolecospores as described in *Cryptosporella viticola*, which are considered to be a degenerate form of conidia.

A pycnidial stage of *L. hysterioides*, of the same type as the genus *Leptostroma*, was found on fallen leaves of *Crataegus monogyna*. The pycnidia measured 100 to 120 μ in diameter and contained oblong, cylindrical, slightly curved pycnospores, 4 to 5 by 2 to 3 μ, which the author failed to germinate.

In *R. urticae* the summer conidia are accompanied by 'pycnoperithecia' which contain bicellular pycnospores, 6 to 7 by 2 to 3 μ in diameter and germinating to produce a winter generation of budding conidia, 4 by 3 μ in diameter. What the author regards as true perithecia are similarly formed, but he has not succeeded in finding ascospores.

Cytological details of the development of the perithecia are given in each case.

[This paper has been reprinted in *Rev. Gén. Bot.*, xxxviii, 445, pp. 5–30; 446, pp. 95–106; et seq., 8 pl., 1926.]

PETRAK (F.) & SYDOW (H.). **Kritisch-systematische Originaluntersuchungen über Pyrenomyzeten, Sphaeropsideen und Melanconieen.** [Critical systematic original researches among the Pyrenomycetes, the Sphaeropsidales, and the Melanconiales.] —*Ann. Mycol.*, xxiii, 3–6, pp. 209–294, 1925.

This is the third part of a series of notices, the first two of which

appeared in recent numbers of the same journal, giving the results of the authors' examination of type or authentic material of species belonging to these three groups. Eighty-two species are dealt with in the present part, several of which are parasitic on plants of economic importance.

CHARLAN (F.). **Las viruelas y rullas del Tabaco en la República Argentina.** [Tobacco wildfire in the Argentine Republic.]—*Min. Agric. Nac. (Buenos Aires) Secc. Prop. e Inform. Circ.* 397, 4 pp., 1925.

Tobacco wildfire, caused by *Bacterium tabacum*, was first identified in the Argentine Republic towards the end of 1924, but is believed to have been in the country for a considerable time, having either been overlooked or confused with some of the other prevalent diseases. It is widespread in Corriente, Salta, and Tucumán, and isolated cases, which are attributed to the use of infected seed, have also been recorded in Misiones.

The control measures recommended are based largely on the use of healthy seed and the prevention of infection of the seed-beds. They correspond with those employed in North America [see this *Review*, v, p. 138].

NEWTON (A. C.). **Formaldehyde treatment for bacterial diseases of Tobacco.**—*Rhodesia Agric. Journ.*, xxii, 8, pp. 861–862, 1925.

Tests were conducted under laboratory conditions at room temperature to determine the difference in the germination percentage of tobacco seed infected with wildfire and angular spot [*Bacterium tabacum* and *Bact. angulatum*] before and after disinfection with formalin. The results of the experiments showed that in no case was the seed permanently injured to an appreciable extent by the treatment [see this *Review*, iv, p. 510], though some retardation of germination was observed in about 25 per cent. of the samples. The average percentage of germination in 8, 15, and 25 days was 76, 85, and 92 respectively, before treatment, and 56, 81, and 89 after disinfection.

The principal sanitary measures for the control of these diseases are briefly recapitulated.

NICHOLLS (H. M.). **Tomato wilt.**—*New Zealand Fruitgrower*, viii, 1, p. 38, 1925.

A brief popular account is given of the symptoms and control of tomato wilt (*Fusarium*) [? *lycopersici*], which is stated to be causing heavy losses in Tasmania. The writer recommends for its control thorough sanitation, half-an-hour's immersion of the seed in 1 per cent. solution of formalin or 1 in 1,000 corrosive sublimate, and the application of Bordeaux mixture, beginning when the plants are six inches high and ending when the flower buds are formed.

GARDNER (M. W.). **Hyperplastic crushing of the tracheal tubes in mosaic Tomato stems.**—*Phytopath.*, xv, 12, pp. 759–762, 2 pl., 1925.

It has been shown [see this *Review*, iv, p. 708] that the necrotic

regions in tomato fruits affected by the severe streak or winter blight type of mosaic are frequently characterized by hyperplasia or proliferation of the adjacent cells. The necrotic surface streaks on mosaic tomato stems, as well as the internal necrotic lesions, have been described by several observers [see this *Review*, v, p. 195]. A certain type of necrotic streaking of the stem being an apparently reliable indication of mosaic, it should be noted that there are early references to this disturbance, e.g., in a letter cited by Plowright (*Gard. Chron.*, iii, p. 532, 1887) which antedates Bailey's account (*Cornell Agric. Exper. Stat. Bull.*, 43, p. 149, 1892).

The necrosis may occur close to the growing point in the very young regions of the stem. Hypertrophy of the adjacent cells may be present in this young tissue, but extensive hyperplasia is usually found somewhat farther back from the growing tip.

The necrotic pockets in the pith resemble those found by Kunkel in mosaic maize and sugar-cane [see this *Review*, i, p. 194; ii, p. 241]. The affected cells collapse, and cavities of varying size and shape are formed. Hyperplasia of the adjacent pith cells commonly occurs. In the stems and petioles the hyperplasia resembles that previously described in the fruit [loc. cit.], consisting of zones, cushions, or whorls of thin-walled meristematic cells, without intercellular spaces, converging towards and crushing the necrotic cells.

Necrosis of the cortex may also be accompanied by hyperplasia in the deeper areas, in the shape of a cushion of thin-walled, rectangular cells, extending outwards from the phloem region against the necrotic zone.

The most active hyperplastic response occurs, however, when the necrosis is in close proximity to the cambium. Plates of necrotic tissue, parallel to the cambial zone, are accompanied by a proliferative growth apparently originating in the phloem region and pushing radially inward against the necrotic tissue and the xylem. This growth is visible under a hand lens as a glassy zone, up to 600 μ in radial thickness, bordered on the inner surface by a thin, brown, necrotic plane. The hyperplastic tissue consists of short, thin-walled, densely packed cells, quite unlike the xylem elements normally present in this region.

Considerable pressure in an inward direction is developed by these internal growths, which not only flatten the necrotic cells but also invade the xylem and crush any tracheal tubes they may encounter. The lumina of these tubes are completely obliterated, and in cases where such growths occupy a large proportion of the circumference of the xylem cylinder, the water supply to the distal portions of the stem may be partially arrested, thereby accounting for certain effects of the disease, including wilting of the young leaves.

Sartoris (G. B.) & Kauffman (C. H.). **The development and taxonomic position of Apiosporina collinsii.**—*Papers Michigan Acad. Science, Arts and Letters*, v, pp. 149–162, 4 pl., 1926.

Characteristic witches' brooms are produced on *Amelanchier canadensis* in various parts of America by the parasitic fungus *Apiosporina collinsii* (Schw.) v. Hoehn. [see this *Review*, v, p. 282].

In March or April the mycelium of this fungus appears on the under surface of the leaves which have just emerged from the bud and soon covers the dorsal surface with a brownish mat, on which conidia develop profusely until June or July, when perithecia begin to form. The latter appear as scattered black dots, at first near the midrib and then covering most of the surface with the black, stroma-like layer in which they are immersed. The ascospores do not mature until the end of the following February, the leaves remaining still on the distorted shoots. Pycnidia appear in the autumn when the intercellular parasitic mycelium has fully permeated the leaf. A perennial mycelium has not been detected, nor did the witches' brooms, when placed in healthy trees, spread the disease. The ascospores appear to be the only active agents in disseminating the fungus, all experiments with the conidia failing to produce infection.

The mycelium remains superficial until midsummer and then penetrates the leaf. No haustoria are formed. The conidiophores arise from the superficial mycelium as erect stout hyphae, bearing a single, lemon-shaped, unicellular conidium. The pycnidia are flask-shaped and contain unseptate, spindle-shaped pycnospores or spermatia. The perithecia are without ostioles and are regarded as showing closer relations with those of the Sphaeriaceae than with any other group.

Details are given of the development and cytology of the fungus.

Guyot (L.). **Le dépérissement des Ormes.** [The dying-off of Elms.]—*Journ. d'Agric. Prat.*, xc, 3, pp. 53–54, 1 fig., 1926.

A brief account is given of the dying-off of elms [see this *Review*, v, p. 66] which was first observed in the north of France in 1918, and mention is made of the various theories advanced for its explanation. A sudden yellow discoloration of the leaves, followed within ten days by complete defoliation, is a striking feature of the disease, which may attack trees of any age, in various types of soil, and in the most divergent localities—forests, open country, avenues, or private gardens. In some cases only a part of the tree is affected, healthy branches remaining side by side with withered ones. The symptoms always start at the tip of the branch. The disease is more liable to prove fatal on young than on older trees. There would seem to be no doubt of its infectious character, and it frequently spreads in a radial manner from a centre, or from one end of a row to the other.

Mayor (E.). **Etude expérimentale de quelques Urédinées.** [Experimental investigation of some Uredineae.]—*Bull. Soc. Neuchâtel. Sci. Nat.*, l, pp. 82–94, 1925. [Received March, 1926.]

In continuation of his previous studies [see this *Review*, ii, p. 586] the writer, in May 1923, inoculated five seedlings of *Abies pectinata* with teleutospores of *Hyalopsora polypodii-dryopteridis* collected on *Dryopteris linnaeana*. Pycnidia were formed from 30th April, 1924, onwards. On 11th April, 1925, aecidia were observed on three-year-old needles of the five seedlings which bore pycnidia the previous year. Thus the supposition that the fungus requires a

period of four years for the completion of its life-cycle [loc. cit.] was confirmed.

Bell has recently described (*Bot. Gaz.*, lxxvii, 1, 1924) the formation of the pycnidia and aecidia of *Peridermium pycnoconspicuum* on three-year-old needles of *A. balsamea* in the United States. Inoculations on *D. linnaeana* with the aecidiospores gave positive results. The aecidia of *P. pycnoconspicuum* are stated closely to resemble those observed by the author on *A. pectinata*, and it may therefore be assumed that *H. polypodii-dryopteridis* forms its aecidial stage on *A. pectinata* in Europe and on *A. balsamea* in North America [see also this *Review*, iii, p. 116].

Previous investigations by the writer having indicated that the only varieties of willow susceptible to infection by the caeoma of *Melampsora abietis-caprearum* from *Abies pectinata* and other species of *Abies* were those with variegated bracts, a series of experiments was carried out to ascertain the reaction of a number of Swiss willows to inoculation with this fungus. Positive results were obtained on eleven species with variegated bracts, including *Salix caprea*, *S. cinerea*, *S. purpurea*, and *S. viminalis*, while eight species with bracts of a uniform colour, including *S. alba* and *S. fragilis*, were immune.

OFFNER (J.) & HEIM (R.). **A propos du Pleurote des Ombellifères.** [Note on the *Pleurotus* of the Umbelliferae.]—*Comptes Rendus Acad. des Sciences*, clxxxi, 21, pp. 809–811, 1925.

Referring to their previous note on *Pleurotus eryngii* growing on dead stocks of *Laserpitium* in the Alpine meadows [see this *Review*, iv, p. 194], the authors do not agree with Costantin's view, expressed in a recent communication [see this *Review*, v, p. 176], that there is an 'occult' parasitism in this fungus. In the absence of a detailed description of the technique followed by Costantin in his infection experiments, it is questionable, in their opinion, whether the mycelium found on the necrotic portions of hosts was that of the *Pleurotus*, and even if it were, there is still the probability that the fungus established itself on dying or dead tissues around traumatic lesions caused by the transplantation of the plants. In support of their view, the authors refer to the results of Lutz's experiments on the specificity of *Pleurotus* [see this *Review*, iv, p. 515], and also to their own repeated infection experiments with *P. eryngii* f. *nebrodensis* on living root stocks of *Eryngium campestre*, *E. alpinum*, and *Laserpitium latifolium*, all of which gave negative results.

ROZANOVA (Mme M. A.). О распространении **Polyporus betulinus Fr., Fomes fomentarius Fr.,** и **Fomes igniarius Fr.** в Березовых рощах Звенигородского уезда Московской губернии. [On the distribution of *Polyporus betulinus* Fr., *Fomes fomentarius* Fr., and *Fomes igniarius* Fr. in the Birch forests of the Zvenigorod district in the government of Moscow].—*La Défense des Plantes*, Leningrad, ii, 1, pp. 24–25, 1925. [Received March, 1926.]

The results of a survey made by the author in 1917 of the birch woods in the Zvenigorod district of the government of Moscow

showed that in that locality the chief parasite of living birches is *Fomes igniarius*, with an average percentage of incidence of 25 in 25- to 40-year-old woods and of 35 in 60-year-old stands, while in birch woods on sphagnum marsh soil only about 3 per cent. of the trees were attacked. The explanation of this lower incidence of the fungus in the latter case may be sought in the greater density of the wood of the trees growing on sphagnum soils. *Polyporus betulinus* and *Fomes fomentarius* appeared to live much more as saprophytes than as parasites in the region in question, this being in direct contradiction with the observations of the author and of Jaczewski in the government of Smolensk, where these two organisms were found to be equally saprophytic and parasitic. It is suggested that this discrepancy may be due to the fact that in the government of Smolensk birches usually grow as an admixture in tall spruce woods, this having a depressing effect on their vitality. In order to test the resistance of healthy birches to both fungi, the author made artificial infection experiments on six healthy 30-year-old trees; at the end of a year no symptoms of infection had developed, but the author was not able to follow further the fate of the infected trees.

Out of 26 birches thrown down by a storm in 1917 in the region, 22 were found to be attacked by *F. igniarius*, two by *F. fomentarius*, and two were entirely healthy.

DOROGIN (G. N.). **Trichosporium lignicolum sp. n.**—*La Défense des Plantes*, Leningrad, ii, 2, pp. 90–91, 1 fig., 1925. [Received March, 1926.]

A black-brown, sooty mould covering blocks of sawn pine wood (*Pinus sylvestris*) sent for examination to the Mycological Bureau in Leningrad from the Ural region [Russia], was found to consist of interwoven, or even agglutinated, articulate hyphae, from 2 to 4 μ broad, bearing laterally, on hardly perceptible protuberances, brownish-purple, spherical, warty spores, from 12 to 17 μ in diameter. In water the spores readily germinated by the emission of one, more rarely two, hyaline cells, which then elongated into a hyaline hypha. The mould was only superficial and did not appear to cause any injury to the wood, but attention is called to it as it might be easily mistaken by the uninitiated for the early stage of a dangerous rot.

The causal organism is referred to the genus *Trichosporium*, and as it does not appear to have been previously described, the specific name *lignicolum* is suggested for it. A brief Latin diagnosis is appended.

NAOUMOVA (Mlle N. I.). Болезни огородных растений в Детском Селе за **1923** и **1924** гг. [Diseases of vegetable garden crops in Detskoye Selo in 1923 and 1924.]—*La Défense des Plantes*, Leningrad, ii, 4–5, pp. 242–245, 1925. [Received March, 1926.]

This is a list, arranged by hosts, of the most prevalent diseases of vegetable garden plants at Detskoye Selo, in the neighbourhood of Leningrad, together with brief notes on their occurrence during the years 1923 and 1924. Of interest is the discovery in one locality of what is stated to be a new disease of potatoes, in which

withered and dying stems of the plants were covered by very minute pycnidia, 80 to 160·7 by 50 to 127·9 μ in diameter, and containing two-celled spores, measuring 4·92 to 9·84 by 1·5 to 3·28 μ. The author considers the causal organism to be a hitherto undescribed species of *Ascochyta*. *Rhizoctonia violacea* was found in 1923 attacking an adult cabbage plant; it caused a penetrating rot at the base of the petioles of the two lower leaves, which later fell off. As far as the author is aware, this is the first case known of this fungus parasitizing adult cabbage, and in spite of careful search, no second case was found.

ERWIN (A. T.). **The development of a yellows resistant strain of early Cabbage for the Corn belt.**—*Minnesota Horticulturist*, liv, 1, pp. 20–22, 1926.

Within three years after the introduction of yellows [*Fusarium conglutinans*] into the Muscatine Island district of south-eastern Iowa, the cabbage yields were reduced by 75 per cent. in an area under the crop of 2,000 acres or more. The symptoms of the disease are briefly described, and a short account is given of the writer's attempts (in conjunction with Melhus) to develop resistant strains of the Copenhagen Market variety. During the past season an 85 per cent. stand, with a yield of 13 tons per acre compared with 5 tons from commercial seed, was obtained in an infested field planted with Iacope cabbage. The objection to this strain, from a commercial standpoint, is its late maturity. Altogether the problem of combining resistance with precocity has proved very difficult.

DOOLITTLE (S. P.) & JONES (F. R.). **The mosaic disease in the garden Pea and other legumes.**—*Phytopath.*, xv, 12, pp. 763–771, 1 pl., 1925.

Mosaic disease of garden peas is widely distributed in Wisconsin [see this *Review*, v, p. 69], but it appears to cause little damage except on late varieties. Sweet peas (*Lathyrus odoratus*), however, are extremely susceptible to infection, and their cultivation seems to have been generally abandoned at Madison as a result of heavy losses. The most common leguminous host of mosaic in and near pea fields and gardens is red clover (*Trifolium pratense*).

Under Wisconsin conditions, the mosaic of the garden pea is characterized by a distinct mottling of the leaves, but there is little curling, wrinkling, or general deformity, and no large green areas, such as occur in tobacco mosaic. In advanced stages the dark green areas, which are usually along the smaller veins, may be replaced by yellowish-green patches. There may be considerable dwarfing, and the pods are fewer and smaller than those of healthy plants. The incubation period of the disease seems to range from 6 to 14 days.

In diseased sweet peas, in addition to the mottling, the affected leaves develop a pronounced upward curling of the edges, and small, elongated, generally depressed areas, apparently thinner than the rest of the leaf, are a conspicuous symptom. There may also be much stunting of the tops and roots, while the blossoms are few, streaked, and abnormally pale.

Inoculations of garden peas both by aphids fed on diseased plants and by crushed leaf tissue were successful in transmitting the disease. Similar experiments on sweet peas confirmed the results obtained by Taubenhaus (*Delaware Agric. Exper. Stat. Bull.* 106, 1914). This mosaic also was found to be transmissible by both the above methods.

Cross-inoculation experiments, both by means of the pea aphis and by the use of expressed juice from mosaic plants, showed that sweet pea mosaic is transmissible to garden peas and vice versa. Field observations indicated that mosaic of red clover also is transmissible to peas. In July, 1924, 96 per cent. of the peas in a row adjoining a plot of infected clover showed mosaic symptoms. The amount of infection decreased in each succeeding row, only 50 per cent. being counted in the fourth row from the diseased clover plot. These observations were confirmed by cross-inoculations from mosaic red clover to peas, both aphids and crushed leaf tissue transmitting the disease.

Inoculations from diseased red clover were made by the crushed leaf tissue method on 62 sweet pea plants, 14 of which developed the disease, while the 60 controls remained healthy. Evidence was further obtained that the pea aphis can transmit sweet pea mosaic to healthy red clover. Cross-inoculation from mosaic sweet clover (*Melilotus alba*) and beans to garden and sweet peas gave negative results.

Dickson has reported seed transmission of pea mosaic in certain varieties [see this *Review*, iii, p. 730], but the writers' experiments with over 1,900 plants of eight varieties gave no evidence of this.

SALMON (E. S.) & WARE (W. M.). **Downy mildew of Mangold and Beet.**—*Journ. Min. Agric.*, xxxii, 9, pp. 833–838, 1 pl., 1 fig., 1925.

In June, 1925, an outbreak of the downy mildew (*Peronospora schachtii*) was reported on a mangold crop in the south of England. The affected plants were either entirely rotted or showed a thickened and stunted main stem about a foot high, with several secondary stems arising from the side of the crown. The large outer leaves remained healthy, but the smaller leaves on the main stem were twisted, puckered, and thickened, and their under surface was thickly covered with a felt-like mass of conidiophores. A black rot was produced at the top of the crown, and, in the more advanced cases, the secondary stems showed wilting. These symptoms, however, were probably due to infection by other fungi or bacteria following the injury caused by the downy mildew.

The mycelium was found to extend from the hypocotyl up the main stem and was also present in the leaves. No oospores were found. The possibility that the disease is seed borne [see this *Review*, iii, p. 729] is discussed, while the sudden appearance of the disease in a crop being grown for seed is thought to be perhaps due to an overwintering mycelium in the crown of the 'root', the first season's attack causing little damage but leading to infection of the crown, from which the stems are invaded the following year [see this *Review*, ii, p. 485].

Control measures on the lines advocated on the Continent are recommended.

CARSNER (E.). **Attenuation of the virus of Sugar Beet curly-top.**—*Phytopath.*, xv, 12, pp. 745–757, 5 pl., 1925.

It has previously been shown [see this *Review*, iii, p. 538] that the virus of curly top disease of sugar beets is attenuated to such a degree by passage through *Chenopodium murale*, that it produces little or no infection when transferred to healthy young beets. In the present paper the writer records, in tabular form, the results of 33 experiments in which leafhoppers (*Eutettix tenella*) from infective parents, reared on *C. murale*, were caged on one or more healthy sugar beets or other susceptible plants. In twenty of these tests, the plants to which the leafhoppers were transferred from *C. murale* remained healthy, while 19 of the sugar beets used in the remaining 13 tests developed the first symptoms of the disease. Fifteen of the plants thus affected subsequently lost all trace of infection or developed only very mild symptoms. In some of the tests chickweed (*Stellaria media*), which is very susceptible to curly top, was used in addition to the beets with similar results.

The fact that the leafhoppers may be carrying the attenuated virus from *C. murale* does not preclude their transmission of the more active virus. Tests were made in which insects reared on *C. murale* produced the mild form of curly top in beets and were then caged for a few days on a plant suffering from the severe form of the disease, and finally transferred to healthy beets, which developed pronounced symptoms.

Tests made on *Rumex crispus* grown from seed showed that this plant is resistant to the action of the virus, which is attenuated by passage through it.

Suaeda moquini, a perennial which is thought to be of considerable importance in tiding the leafhopper over the dry periods of autumn and early winter, was also shown by experiments to attenuate the virus in a similar manner.

This is believed to be the first record of attenuation of a plant-disease virus. In view of the evidence that the virus producing the mild disease is identical with that causing the severe form, and of the essential similarity of the symptoms, the mild form is considered to be merely a variant and not a distinct disease.

The milder form of the disease in the south as compared with the central part of California may possibly be explained by the fact that sugar beets have been continuously and extensively grown in the latter region, thereby securing the retention of the virus in a virulent form, while in the former the leafhoppers are obliged to depend mainly on wild plants for the maintenance of the virus, which in such cases subsists only in an attenuated form.

So far the writer's tests have given no indication of a possible restoration of virulence by passing the attenuated virus through sugar beets or even more susceptible plants.

MELHUS (I. E.) & ELMER (O. H.). **Diseases of Cucumbers and Melons in Iowa.**—*Iowa Agric. Exper. Stat. Circ.* 99, 16 pp., 7 figs., 1925.

Cucumbers and watermelons grown in the State of Iowa are stated to suffer severe losses from diseases caused by bacteria and fungi. The authors give a popular account of the following:

anthracnose [*Colletotrichum lagenarium*], very frequent on cantaloupe and watermelon; bacterial wilt [*Bacillus tracheiphilus*], and mosaic, affecting cucumber and cantaloupe; *Fusarium* wilt of watermelon [*F. niveum*]; and angular leaf spot of cucumber [*Bacterium lacrymans*].

Practical directions are added for the treatment of these diseases by seed disinfection, spraying, and dusting, and a home-made barrel dust mixer is figured.

WALKER (M. N.). **The relation of certain species of Physalis to the overwintering of the mosaic disease of Cucumber.**—*Phytopath.*, xv, 12, pp. 733–744, 2 pl., 1925.

While eradicating the wild hosts of cucumber mosaic at Rockland, Wisconsin, in 1922, the writer observed that numbers of infected ground cherry plants (*Physalis pubescens*) occurred near four of the most severely diseased cucumber fields [see also this *Review*, v, p. 143]. Inoculation tests were made on healthy cucumbers with crushed leaf tissue from infected ground cherry plants with negative results. Subsequently, healthy and diseased ground cherry plants from the infected region were transferred to a greenhouse and colonized by aphids (*Aphis gossypii*) from healthy cucumbers: after 24 hours the insects were transferred to healthy young cucumbers under cheesecloth cages, and a high percentage of mosaic obtained. Later, infection was also obtained in a few inoculations made with crushed leaf tissues, but the percentage of infection was lower than where aphids were used. The results of these and other tests described in this paper are presented in tabular form. The incubation period of the mosaic disease of *P. pubescens* ranged from five to fourteen days.

Further experiments showed that cucumber mosaic is transmissible to healthy *Physalis* plants either by direct inoculation with aphids or by the artificial method with crushed leaf tissue.

Aphids from mosaic pokeweed (*Phytolacca decandra*) plants infected healthy ground cherry plants in a few cases. Ground cherry plants were further found to be very susceptible to tomato and tobacco mosaic, and the results of preliminary experiments indicate that *P. pubescens* acts as an intermediate host by which tomato mosaic may be transmitted to the cucumber. Analogous data have been obtained by Doolittle with pepper (*Capsicum annuum*) [see this *Review*, i, p. 122].

The first symptom of mosaic on *Physalis* is a faint yellow flecking of the young leaves, or sometimes a general yellow discoloration of the apical leaves, accompanied by 'savoying' and curling. Sometimes no definite symptoms appear for a considerable time after inoculation, but finally a few sharply defined, blister-like, deep green patches, followed by mottling, crinkling, or dwarfing, are observed in some of the younger leaves. Dwarfing is usually accompanied by striking malformations, e.g., filiform and crinkled leaves with distinctly swollen veins. Under adverse conditions of growth, these symptoms may be masked [see also this *Review*, v, p. 140].

Seed from mosaic *Physalis* produced exclusively healthy plants, so that the cultivated annual ground cherry is apparently not a factor in the overwintering of cucumber mosaic. It was, however,

shown by inoculation experiments that the mosaic diseases of cucumber and of *P. heterophylla* and *P. subglabrata*, two perennials growing abundantly near cucumber fields, are intertransmissible.

Eradication from the experimental area of the perennial species of *Physalis* greatly reduced the incidence of cucumber mosaic in comparison with the previous season.

GOMEZ (E. T.). **Leaf blight of Gabi.**—*Philipp. Agric.*, xiv, 7, pp. 429–440, 1 pl., 2 figs., 1925.

Morphological and cultural studies have shown that the leaf blight of gabi (*Colocasia antiquorum*) occurring in the Philippine Islands (where it was first reported in 1916) is due to *Phytophthora colocasiae* Rac. The disease is also known to occur in Java, India, Japan, and China.

The writer's observations were made on wild and cultivated varieties around Los Baños. In the early stages the disease is characterized by purplish to brownish, water soaked, more or less circular lesions on the leaf, ranging from 1 to 2 cm. in diameter at first and gradually expanding. A clear yellowish liquid exudes from the surface of the infected areas. Eventually almost the whole leaf becomes covered with irregular patches of varying dimensions. Under favourable moisture conditions, rotting extends to the petioles and ultimately to the corm. During the dry season the central portions of the spots assume a yellowish tinge, becoming desiccated and brittle and finally dropping out. The lesions are enclosed by yellowish rings. In the early morning a delicate white growth of conidiophores and conidia may be seen on these borders on the under side of the leaf.

The morphological and cultural characters of the fungus are described. Measurements of 200 conidia from field material gave dimensions of 38·94 to 67·16 by 17·5 to 28·32 μ, the length and width of the greatest number of conidia falling in the classes 58·5 to 60·49 and 22·5 to 24·49 μ, respectively. The diameter of the chlamydospores from pure culture varies from 17·28 to 38·64 μ, with an average of 26·5 to 28·49 μ. Oospores were produced on Lima bean juice agar by Ashby's method (*West Indian Bull.* 18, p. 61, 1920).

The fungus grew best on potato-dextrose agar and potato agar or on upo (*Cucurbita pepo*), papaw (*Carica papaya*), and eggplant fruit cylinders.

The conidia germinate either by germ-tubes or by the production of zoospores. The spores are disseminated by caterpillars (*Hyppotion celerio*), water, and probably also by mechanical means. On dead gabi tissues the conidia retain their viability for three months. Infection may occur on either leaf surface, the fungus gaining admission through the epidermis, the stomata, or through wounds. Under field conditions the incubation period is three to seven days, while in the damp chamber infection is visible 36 to 48 hours after inoculation. Experiments are stated to have shown that infected leaves and corms left in the field after harvest form sources of inoculum for natural infection, probably by means of oospores. The disease has been observed to reach a climax after periods of continuous heavy rain and in warm, moist, cloudy weather.

Inoculation experiments on wounded and unwounded plants

showed that all the native varieties of *C. antiquorum* are susceptible to the disease, while two other aroids, namely, yautia (*Xanthosoma sagittifolia*) and *Caladium* spp., and a number of other plants, including eggplant [*Solanum melongena*], tomato, and citrus are resistant. It is suggested that yautia be substituted for gabi in cases of serious infection, while the incidence of the disease may also be reduced by appropriate cultural measures, crop rotation, and (if necessary) the application of Bordeaux mixture at fortnightly intervals approximately between the end of August and middle of November.

BEAUMONT (A.) & HODSON (W. E. H.). **Second Annual Report of the Department of Plant Pathology, Seale-Hayne Agricultural College, Newton Abbot, Devon, for the year ending September 30th, 1925.** 32 pp., 1926.

In addition to brief notes on the prevalence of some of the chief plant diseases observed during the period under review, this report contains an account of the 'black leg', 'black rot', or 'black more' disease of mangold and beet seedlings widely distributed in Devon and Cornwall, and stated to be identical with the 'wurzelbrand' of beet in Germany [see this *Review*, iv, p. 583]. The attack generally occurs about three or four weeks after sowing and is characterized by the withering and blackening of the root and stem below ground level. Affected plants may recover by the formation of new roots, in which case there are no aerial symptoms of infection, but in severe attacks the foliage wilts and the young plants die. A fungus with black pycnidia resembling those of *Phoma betae* was isolated from a high proportion of the diseased roots, while at least 25 per cent. of the mangold seeds germinated in Petri dishes showed the typical symptoms of black leg. On the other hand, seedlings growing normally in pots were comparatively healthy. It is stated that there is no doubt that the disease is due to fungous infection. The heart rot of mature mangold plants [see this *Review*, iv, p. 521] has not yet been recorded from Devon and Cornwall, and only in one case did artificial inoculation with *P. betae* succeed in causing this type of disease. The only control measures known at present are thorough cultivation, the application of a stimulatory fertilizer, e.g., nitrate of soda, and the use of clean seed.

On 16th February, 1925, perithecia of the apple scab fungus, *Venturia inaequalis*, were observed on apple leaves collected at the Seale-Hayne College Farm in October, 1924. A month later the ascospores were visible. They were liberated during the latter part of April, but all the leaves in the open had disappeared before the emission of the spores could be detected. The presence of perithecia in such abundance would appear to indicate that in England, as in America, the winter stage is an important source of infection.

The extensive manifestations of die-back in south-western apple, pear, and plum orchards are associated with a number of fungi, the most important of which is *Cytospora leucostoma* [see this *Review*, iii, pp. 217, 433]. Other organisms found on the diseased trees include *Sphaeropsis malorum* [*Physalospora cydoniae*: see this *Review*, iv, p. 636], *Phomopsis mali*, *Tubercularia vulgaris* [*Nectria*

cinnabarina], and species of *Dothiorella* and *Glomerella*. *Diaporthe perniciosa* was not observed, and its pycnidial stage, *P. mali* [see this *Review*, iv, p. 174], was clearly saprophytic. The recent view of die-back fungi as weak parasites, which can only damage trees with a lowered vitality, is stated to be supported by general observations in Devon and Cornwall; but the whole problem of the relation of these organisms to the death of the twigs is one of great complexity.

The following fungi have frequently been found on dead or dying raspberry canes in various parts of Devon and Cornwall: *Didymella applanata* [see this *Review*, ii, p. 128], *Hendersonia rubi*, *Coniothyrium* sp., *Phoma herbarum*, *Pleospora herbarum*, *Ascochyta pallor*, and *Septoria rubi*. Of these, all except the first-named were almost certainly saprophytic. The recently described blue stripe wilt (*Verticillium* sp.) [see this *Review*, iv, p. 748] has also been found, causing extensive damage in one case. The Baumforth's Seedling and Bath's Perfection [Marlborough] are among the most susceptible varieties. Raspberry mosaic has only recently attracted attention [see this *Review*, iv, p. 99], but there is no doubt as to its serious effect on the yield of the fruit and vigour of the canes. It spreads very slowly and may be effectively controlled by roguing.

The results of an extensive field and laboratory inspection of diseased narcissus bulbs showed that the most important fungous trouble is caused by *Fusarium bulbigenum* Cke and Mass., which is stated to be frequently confused with the attacks of the bulb eelworm (*Tylenchus dipsaci*). The fungus often follows the nematode, but it has been observed to occur independently, causing damage to 10 per cent. of one lot of several hundred bulbs. *F. bulbigenum* produces less symmetrical decayed areas than *T. dipsaci* and varies somewhat in its mode of attack. Sometimes only the outer fleshy scales turn brown and often the root plate is also rotted. There are stated to be at least two types of sclerotial diseases, one characterized by large, black, shiny, oval or irregular, sometimes compressed sclerotia, measuring 2 to 5 mm. in length; and the other by globular, black sclerotia only $\frac{1}{10}$ mm. in diameter. The latter form has only been observed in bulbs from the Scilly Isles. *Ramularia vallisumbrosae* causes considerable damage to narcissus foliage in the Tamar area in fairly warm, damp weather. Pale yellow streaks are formed on the leaves, and white powdery masses of spores are produced until May, unless a dry cold spell supervenes, when the spread of the disease is temporarily arrested. Numerous minute black bodies, probably representing the resting stage of the fungus, may be seen on the dead leaves. *Botrytis cinerea* frequently infects narcissus foliage during May in the Scilly Isles. It is probably transmitted from potato leaves.

ZELLE (M. O.). Грибні хвороби рослин на Київщині в **1923–24**, p.p. [Fungal diseases of plants in the government of Kieff in the years 1923–24.]—*Kieff Plant Protection Stat.*, Ser. 5 (Science), 3, 28 pp., 1925. [Received March, 1926.]

This paper comprises a list of some 350 parasitic fungi, arranged

by families, that were recorded on cultivated, or in some cases on wild, plants in the government of Kieff [Ukraine] during 1923 and 1924. In each case the host, locality, and date of collection are given. The species recorded are mostly common plant pathogens.

CARNE (W. M.). **Report of the Economic Botanist and Plant Pathologist.**—*Ann. Rept. Dept. of Agric. Western Australia for year ended 30th June, 1925,* pp. 20–21, 1925. [Received March, 1926.]

Special attention was given during the period under review to the following phytopathological problems. Citrus rots and storage diseases; bitter pit and mouldy core of apples (in co-operation with the Department of Scientific and Industrial Research); red root and bulb rot of onions; pink grains and empty heads of wheat; spotted wilt of tomatoes [see this *Review,* iii, p. 307]; and timber rots (in conjunction with the Forest Department).

RHIND (D.). **Annual Report of the Mycologist, Burma, for the year ended the 30th June, 1925.**—Rangoon, Supdt., Govt. Printing and Stationery, Burma, 5 pp., 1926.

False smut and bunt of rice (*Ustilaginoidea virens* and *Tilletia horrida*) appear to have been more prevalent than usual, but caused on the whole little damage during the period under review. A very serious disease, closely resembling that known in Bengal as 'ufra' [see this *Review,* iii, p. 123] and associated with the presence of nematodes similar to *Tylenchus angustus,* was observed for the first time in the Irrawaddy Delta. Slight damage was also caused by this disease, which appeared in roundish areas of about one acre, on rice at Mandalay. *Sclerotium oryzae* was of widespread occurrence but caused little injury.

The root disease of sesame [*Sesamum indicum*] reported in 1924 [see this *Review,* iv, p. 259] was again destructive in the East and West Central Circles, the losses over the whole area probably averaging 10 per cent. *Rhizoctonia solani* was almost invariably found on the dead plants. Seed disinfection experiments are in progress at Allanmyo.

Groundnuts [*Arachis hypogaea*] are liable to slight attacks by *Sclerotium rolfsii* in damp localities.

Black thread of rubber (*Phytophthora meadii*) was prevalent on nearly all the large plantations visited near Moulmein and Amherst, chiefly owing to the continuation of tapping after the break of the monsoon. Abnormal leaf fall [also due to *P. meadii*] was widespread and does not appear to be amenable to control. Root diseases are stated to be almost absent, *Ustulina zonata* being the only one observed in a few cases round Moulmein.

Wilt was the only cotton disease reported during the year, the Wagale variety being chiefly affected. A selection from Wagale, however, has been found more resistant to wilt than most Indian cottons. A species of *Fusarium* resembling *F. vasinfectum* has been isolated from diseased plants in several localities.

Grey blight and brown blight of tea [*Pestalozzia theae* and *Glomerella cingulata*] were the commonest leaf diseases on the one

estate visited. A small amount of brown root [*Fomes lamaoensis*] was also present.

A number of fungi, chiefly species of *Fusarium*, have been isolated from wilted Burmese gram [*Cicer arietinum*], but inoculation experiments with these organisms, as also with *S. rolfsii*, gave negative results. It is considered doubtful whether the disease is primarily due to fungi.

Mycology.—*Ann. Rept. Lands & Forests Dept. Sierra Leone for the year 1924*, pp. 17–19, 1926.

Some of the phytopathological records contained in this report are based on notes placed at the disposal of the Lands and Forests Department by Dr. V. C. Dunlap, of Messrs. Elder and Fyffes, who visited Sierra Leone in December 1924.

Panama disease of bananas [*Fusarium cubense*] was widespread between Freetown and Mano.

Angular leaf spot and black arm of cotton (*Bacterium malvacearum*) was found on the imported Allen's Long Staple variety in several localities.

Twig blight of kola [*Cola acuminata*], which was found at Njala, is stated to be caused by a bacterium (*Pseudomonas* sp.) in association with a species of *Fusarium*. The twigs first wilt, assume a brownish discoloration, and finally become coated with a greyish, cottony growth. Microscopic examination revealed large numbers of minute, rod-shaped, slightly motile bacteria, both on the surface and in the tissues of recently infected portions. The *Fusarium* responsible for secondary infection is characterized by long, four- to seven-septate, falcate spores.

Other diseases occurring at Njala included *Helminthosporium oryzae* on rice and *Cephaleuros parasiticus* on rubber, the latter developing in a more actively parasitic form than usual, in association with a *Colletotrichum* (probably the conidial stage of *Glomerella cingulata*). The affected areas may extend to a diameter of several centimetres.

ALTSON (R. A.). **Appendix III. Report of the Assistant Botanist and Mycologist.**—*Rept. Dept. of Sci. and Agric. Brit. Guiana for the year 1924*, pp. 45–54, 1926.

The study of the etiology of root rot of sugar-cane [see this *Review*, iv, p. 462] was continued. During a visit to Trinidad an experiment was conducted to test the pathogenicity and relation to root rot of two strains of *Sclerotium rolfsii* from affected canes at Berbice (British Guiana) and Trinidad, respectively; two of *Rhizoctonia solani*; and one of *Pythium* sp. Inoculations through the soil with these fungi on the extremely susceptible Bourbon cane gave no definite symptoms of disease in the root system in a fortnight, after which the observations had to be suspended.

Melanconium sacchari is stated to occur invariably as a secondary infection on plants debilitated by root disease.

Two slight outbreaks of top rot [loc. cit.] were reported towards the end of July, one from the east and the other from the west coast of Demerara. In British Guiana top rot is quite distinct from root disease, two important symptoms of which, namely, gumming

of the vascular tissue in the basal nodes and a poorly developed and decayed root system, are conspicuous by their absence in the former disturbance. Pure cultures of the bacterial strains previously isolated from affected material [loc. cit.], together with a third strain since obtained, were inoculated into healthy canes with negative results.

Detailed evidence is presented showing that the cane chlorosis previously reported [see this *Review*, v, p. 3] is not identical with mosaic, but is probably due to some nutritional disturbance.

A rather severe outbreak of ring spot of cane leaves (*Leptosphaeria sacchari*) occurred on the east coast, the D. 109 and D. 145 varieties being heavily damaged. Pineapple disease of sugar-cane (*Thielaviopsis paradoxa*) occurs chiefly on 'pegasse' soils. Red spot of the cane sheaths (*Cercospora vaginae*) is widely prevalent.

In British Guiana bud rot of coco-nuts appears to be primarily due to unfavourable soil conditions, the deleterious effects of which are frequently aggravated by cultural neglect.

An epidemic of rice blast (*Piricularia grisea*) [*P. oryzae*] occurred in an experimental field, the Ceylon variety H. J. 16 being heavily infected. It was observed that infection commonly took place on the leaf or at the junction of the leaf blade and sheath. In the former case, minute brown spots, gradually developing into elongated oval, brown areas, with greyish centres from which the conidiophores are extruded, appear on the leaf surface and eventually destroy the entire blade. When infection occurs at the junction of the lamina and sheath, the affected tissues lose their turgor and the leaf falls over. Infection from this point may spread down the sheath and involve the stem.

Plantains [*Musa paradisiaca*] and dwarf bananas (*M. cavendishii*) were affected by an apparently infectious disease which is thought to be possibly of the same nature as that described by Rorer from Trinidad under the name of 'moko disease' [and attributed by him to *Bacillus musae*: see *Phytopath.*, i, 2, pp. 45–49, 1911]. The disturbance is also believed to be identical with that recorded by Stockdale in 1909 as having existed for some years in British Guiana. The etiology of the disease is still obscure, and so far little has been done in the way of control, in spite of the heavy losses caused by its ravages in a most important crop.

Witches' broom of cacao (*Marasmius perniciosus*) is still prevalent, and the control measures prescribed by the Board of Agriculture have been almost entirely neglected. In some of the larger plantations infection is believed to have reached a maximum and any further extension of the disease is considered unlikely. Neglect of field sanitation and unduly heavy shade continue to favour the development of cacao pod rot (*Phytophthora faberi*).

Twelve- to fourteen-year-old Liberian coffee bushes, growing on shallow 'pegasse' soil on one estate on the Pomeroon River, were attacked by a rapid wilting associated with ill-defined chlorotic symptoms. The withered leaves adhered to the branches after the death of the trees. An unidentified fungus was isolated from the decayed roots. The external symptoms resemble those of the phloem-necrosis occurring in Surinam [see this *Review*, iv, p. 723] but the identity of the two conditions has not yet been established.

Most of the inland rubber plantations have been abandoned on

account of the ravages caused by the epidemic leaf disease (*Melanopsamminopsis ulei*) [see above, p. 324], but a good many of the smaller coast estates are comparatively free from infection, presumably owing to the influence of trade winds in preventing conidial germination.

Mango anthracnose (*Gloeosporium mangiferae*) was extremely prevalent, and a mild epidemic of black spot of roses (*Diplocarpon rosae*) occurred in the autumn.

MARTIN (W. H.). **Report of the Department of Plant Pathology.** —*Forty-fifth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1924*, pp. 373–381, 1925. [Received March, 1926.]

The following are some of the chief records of interest in this report.

Twenty-year-old Williams apple trees showed both the aerial and root form of crown gall (*Bacterium tumefaciens*), while Jonathans and Paragons in the same orchard exhibited the latter type of infection only.

Cabbage yellows (*Fusarium conglutinans*) caused very heavy damage in Camden County, even when sterilized seed was sown. The Early Jersey Wakefield was more resistant than Copenhagen.

Chrysanthemum wilt (*Verticillium albo-atrum*) has been observed for six years on outdoor and greenhouse plants, the Pink Seilewich, Early Snow, and P. A. Dove varieties being very susceptible.

Spray injury following the use of atomic sulphur or dry-mix sulphur lime [see this *Review*, v, p. 311] was observed in peach orchards in Cumberland County and New Brunswick, respectively.

Potato wilt (*F. oxysporum*) was more severe than at any time during the past seven years, causing 5 to 100 per cent. damage in the central and southern districts. Leaf roll was particularly severe on Irish Cobbler potatoes, the American Giant and Green Mountain also being affected. Scab (*Actinomyces scabies*) was most severe in a variety test on American Giant (62·6 per cent.) and mildest on Green Mountain (6·2 per cent.); heavy infection (up to 100 per cent.) was observed in some fields of Irish Cobblers.

Anthracnose of raspberries (*Plectodiscella veneta*) was well controlled in a spray test by the application of concentrated lime-sulphur, 97 per cent. of the plants being healthy compared with 25 per cent. in the untreated plots.

Stem rot of sweet potatoes (*F. batatatis* and *F. hyperoxysporum*) was much more prevalent than usual, causing a reduction of 30 per cent. in the crop.

Tomato wilt (*F. lycopersici*) affected about 80 per cent. of the fields examined and reduced the crop by 3 per cent. Blossom-end rot caused a similar reduction.

RIKER (A. J.). **Studies on the influence of some environmental factors on the development of crown gall.**—*Journ. Agric. Res.*, xxxii, 1, pp. 83–96, 3 pl., 2 figs., 1926.

The experiments briefly described in the present paper were made in the autumn of 1923 and the spring of 1924 with a view to studying the influence of some environmental factors on plants inoculated with *Bacterium tumefaciens*, and on the pathogen

itself. The strain of the latter used in this study was the same as that employed by the author in his previous work on crown gall [see this *Review*, iii, pp. 125, 386], since when it had been passed twice through tomato.

Preliminary experiments showed that galls developed well on inoculated tomato plants kept for two weeks at a temperature between 18° and 22° C.; at a temperature of 29° to 30° the galls were small and poorly developed; while at a temperature from 36° to 38° there was no proliferation at all of the inoculated tissues. It was further found that keeping inoculated stems of tomato and raspberry saturated with moisture stimulated the development of the galls, as compared with controls exposed to the air. This was especially true of the raspberry.

These results led the author to study more closely the development of crown gall as related to temperature and soil moisture. In the subsequent three series of experiments tomato stems were inoculated by needle punctures with the organism, and the inoculated parts were placed under soil which was held for different plants at 14°, 18°, 22°, 26°, 30°, and 34° C. respectively, while at each of these temperatures soil-moisture tests were also made at 20, 40, 60, and 80 per cent. of the moisture-holding capacity of the soil. The largest galls were found at 22° for all moistures and at 60 per cent. moisture for all temperatures, the development of the galls being reduced at 30° and above, while the aerial parts of the host developed best at temperatures ranging from 22° to 30° and 80 per cent. moisture. Similar experiments with raspberry stems gave inconclusive results in regard to the development of the galls, but suggested a range similar to that of tomatoes.

The critical temperatures for gall formation were further tested in chambers where the air temperatures were closely regulated. At temperatures from 8° to 10° C. the inoculated tomato plants made practically no growth and produced no galls in a month's time. At 28° to 30° the galls developed poorly, and none at all developed above 30°, while the tomato plants grew fairly well at the latter temperatures.

The temperature relations of the organism were studied in cultures on several media, on all of which the largest colonies were produced within the range of 14° to 30° C.

Previous infection of the hosts did not appear to influence the development of galls from new inoculations. Tests for precipitins and agglutinins in the host tissue in the proximity of, and inside the galls, gave negative results, but the organism produced agglutinins when injected intraperitoneally into rabbits. The serum was effective in a dilution of 1 to 3,000.

BONDAR (G.). **O Cacao. II. Molestias e inimigos do Cacaoeiro.** [The Cacao. II. Diseases and pests of the Cacao tree.]—*Secretaria da Agric., Indus., Comm., Viçáo e Obras Publicas, Bahia (Brazil)*, 126 pp., 74 figs., 1925.

In pages 13 to 19 of this pamphlet the author describes the four fungous diseases of common occurrence in the cacao plantations of Bahia, Brazil.

Phytophthora faberi is stated to be frequently responsible for the

loss of 20 to 30 per cent. of the crop, and causes a form of stem canker in addition to the more serious pod disease called locally 'podridão parda' ['grey rot'] and known elsewhere as black pod. This disease is very widespread and does most injury in the rainy season and in crowded plantations. Clearing the bush to allow free ventilation and avoid excessive humidity is advised, and also the burning of all diseased husks.

Lasiodiplodia [*Botryodiplodia*] *theobromae* is also widespread but is of less economic importance, as it is chiefly saprophytic and is rarely found on living parts. Stems, branches, and leaves are susceptible, but the pods are more commonly attacked.

Corticium lilaco-fuscum [*C. salmonicolor*] causes a bark disease in which the mycelium destroys the tissues of the cortex. The damage caused is, however, negligible.

The thread blight [witches' broom] caused by *Marasmius perniciosus* is common on cacao and is said to be found also on various other trees; it can be controlled effectively with Bordeaux mixture.

DORPH-PETERSEN (K.). **Beretning fra Statsfrøkontrollen for det 54. Arbejdsaar fra 1 Juli 1924 til 30 Juni 1925.** [Report of the State Seed Testing Service for the 54th year of activity from 1st July 1924 to 30th June 1925.]—*Tidsskr. for Planteavl*, xxxii, 1, pp. 1–68, 1926.

Section VII of this report (pp. 47–52) contains the following references of phytopathological interest. All the 6 samples of wheat examined were found to be slightly infected by loose smut [*Ustilago tritici*], which is stated to be of very rare occurrence in Denmark. Five samples showed 0·1 to 4 per mille bunt [*Tilletia tritici* and *T. levis*] infection. Eighteen of the 29 samples of barley examined showed traces of loose smut [*U. nuda*] and 17 a very slight incidence of stripe disease [*Helminthosporium gramineum*]. Of the 12 barley samples dusted with various new preparations, 8 remained entirely free from stripe disease and the rest showed only the slightest trace of infection.

Of the 500 barley fields in Zealand inspected for stripe disease, 31 per cent. were completely healthy and 79 per cent. showed under 2 per cent. infection; only 3 per cent. showed over 10 per cent. and 9 per cent. over 5 per cent. of stripe. As in former years, the Guld variety was more heavily infected than the Prentice.

A similar inspection was made of 27 fields in Falster, in 11 of which the seed-grain had been disinfected with new preparations. Nine of these last fields were completely healthy while the 2 others showed only slight infection by *H. gramineum*. Thirteen out of the 27 fields were free from stripe, 7 showed traces of infection, and the remaining 7 from 2·5 to 13 per cent.

DUCOMET (V.) & FOËX (E.). **Introduction à une étude agronomique des rouilles des céréales.** [An introduction to the study of cereal rusts from an agricultural point of view.]—*Ann. des Epiphyties*, xi, 5, pp. 311–411, 10 col. pl., 1925. [Received March, 1926.]

The first part of this paper, which is a very full review of the

present state of knowledge concerning cereal rusts throughout the world, contains an historical account of these diseases, including a summary of Eriksson's work and that of other investigators on the specialization, propagation, and overwintering of the pathogens. This is followed by a detailed account of *Puccinia graminis* (comprising its morphology, modes of propagation from season to season, and relation to the barberry) and of the researches in different parts of the world on the biological specialization of this species. The other species dealt with on similar lines are *P. glumarum*, *P. triticina*, *P. dispersa*, *P. simplex*, and *P. coronata* [*P. lolii*].

The paper terminates by a discussion of the methods in use for the evaluation of the degree of varietal resistance of cereals to rusts, and of a new method of notation proposed by the authors. Briefly summarized, the latter consists in noting separately the number of uredosori found on the various organs; ears (awns and glumes, rachis, grains), stems, and leaves (leaf blade and sheath), expressing the intensity of infection by means of a scale of 5 degrees, from 0 to 4; a system of coefficients is further used which, applied to the degrees of the scale, serve to express the relative gravity of the infection in the given location, and the figures thus obtained are reduced to a percentage notation by means of multiplication factors that are indicated. The method is illustrated by a number of tables, and sample pages of two note-books for entering the observations are given. A bibliography of 606 titles is appended.

PELTIER (G. L.). **A study of the environmental conditions influencing the development of stem rust in the absence of an alternate host. III. Further studies of the viability of the urediniospores of Puccinia graminis tritici.**—*Nebraska Agric. Exper. Stat. Res. Bull.* 34, 12 pp., 1925. [Received March, 1926.]

The author continued his investigation of the bearing of relative humidity and temperature on the viability of the uredospores of *Puccinia graminis tritici* by the study of the behaviour of the spores of the biologic forms IX and XXI [see this *Review*, ii, p. 158] under the same experimental conditions as described in his previous paper on biologic form III [see this *Review*, ii, p. 14]. The results indicated for these two forms the same general relation as for form III between the viability of the uredospores and environmental conditions, namely, that the lower the temperature the longer the spores retained their viability at all relative humidities, while at any given temperature the spores were viable longest at the medium humidities. Uredospores of biologic form XXI kept at 49 per cent. relative humidity and at a temperature of 5° C., at the end of one year gave 30 per cent. germination and produced a heavy infection on 2 out of 12 plants inoculated.

The paper terminates by a discussion of the application of the technique evolved by the author to the storing of rust material during long periods.

PELTIER (G. L.). **A study of the environmental conditions influencing the development of stem rust in the absence of an alternate host. IV. Overwintering of urediniospores of**

Puccinia graminis tritici. V. The period of initial infection of urediniospores of Puccinia graminis tritici on Wheat. VI. Influence of light on infection and subsequent development of urediniospores of Puccinia graminis tritici on Wheat.—*Nebraska Agric. Exper. Stat. Res. Bull.* 35, 11 pp., 1925. [Received March, 1926.]

In the first part of this paper brief details are given of the experiments carried out during the period from 1920 to 1925 with a view to ascertaining whether the uredospores of *Puccinia graminis tritici* can overwinter under the environmental conditions prevailing at Lincoln, Nebraska. The results of the experiments and observation of naturally infected wheat plants in the field showed that uredospores collected after the month of January were no longer viable, as no germination could be obtained from them. The author therefore considers that the question of the over-wintering of the uredospores of this rust under the conditions at Lincoln may be safely answered in the negative.

The experiments reported in the second part were planned to determine the time required by the rust, after reaching a susceptible part of the host, to enter the tissues. The first entry of a germ-tube into a leaf stoma was observed after an exposure to moist conditions of 3 hours; although, at the end of this time, the number of plants infected was small, still some pustules were subsequently formed. At the end of 6 hours, the percentage of plants infected was 17, and with each additional hour of exposure the percentage of infection rose considerably, until after 24 hours nearly 90 per cent. of the plants were infected. When the length of exposure was extended beyond 24 hours, from 92 to 100 per cent. infection was obtained. When exposure was under 24 hours, only a few sori were formed; even with 24 hours exposure, less than 10 sori per leaf developed, but the longer the exposure was prolonged, the greater was the number of the pustules produced. The author concludes from these results that under field conditions, the longer the conditions for infection remain at the optimum, the more uredo-sori will be produced, although some infection can occur when these conditions are maintained for only a few hours.

The results of the experiments described in the third part, made in order to test the influence of light on the initial infection and subsequent development of *P. graminis tritici* biologic form XXI, showed that light is not a factor in the initial infection, but that it is essential for the subsequent development of the disease, in that it is essential for the growth of the host and as such contributes to the development of the pathogen, perhaps through a food relation.

ESMARCH (F.). **Die Rostkrankheiten des Getreides.** [The rust diseases of cereals.]—*Die Kranke Pflanze*, iii, 1, pp. 4–9; 2, pp. 32–38, 1926.

After a brief note on the importance of cereal rusts, with some figures of the losses from this cause in Germany in years of severe epidemics, the writer describes in popular terms the morphology and symptoms of the chief forms.

The external conditions governing their incidence are discussed in the light of the writer's own observations and those of other

investigators. In seasons when May is warm and moist, the incidence of *Puccinia glumarum* is high; similar conditions in July favour outbreaks of *P. graminis* and *P. coronifera* [*P. lolii*]. Other factors of importance in this connexion include the stage of development of the host at the time of infection; the situation of the fields; soil conditions; date of sowing; and effect of preceding crop.

The concluding section of the paper is devoted to the problem of control by cultural measures and selection. The observations on varietal resistance made by Schaffnit and others are stated not to be applicable to Saxony, where work on these lines is urgently needed.

MOURASHKINSKY (K. E.). О влиянии мокрой головни на вегетацию Пшеницы. [The effect of bunt on the growth of Wheat.]—Reprinted from *Trans. Siberian Acad. of Agric.*, iv, 15 pp., 4 graphs, 1925. [Received 1926.]

After a brief introduction in which the present unsatisfactory state of knowledge in regard to the biology of cereal smut diseases, considered as the result of the interaction of host and pathogen, is pointed out, the author describes experiments started in 1924 at the Phytopathological Section of the Siberian Academy of Agriculture [at Omsk, Western Siberia] in an attempt to throw some light on the question by the comparative study of the behaviour of healthy and of infected plants in the open. The experiments bore chiefly on the effect of bunt on the development of a number of named varieties of spring wheat that were artificially inoculated with spores of *Tilletia tritici* and *T. levis*; they were continued in 1925, and are stated to be still in progress, with particular reference to the influence of the origin of the spores on the development of subsequent infection.

The results indicated that both species of *Tilletia* exercise a stunting effect on their host which results in a shortening of all the internodes and in a considerable reduction of the total height of the infected plants. The stunting effect was less pronounced in stems bearing partly infected ears, the height of which was intermediate between that of the control and that of stems with entirely bunted ears. It was further noted that in partly infected stools the apparently healthy stems were shorter than those of the controls, the same being true also in the case of apparently uninfected stools grown from infected seed. This would suggest that the plants can outgrow the mycelium under certain conditions. The intensity of the stunting effect, as measured by the reduction of the height, was not the same in the species and varieties of wheat tested, and also varied with the pathogen, being greater in the case of *T. tritici* than in that of *T. levis*.

Counts made in all the plots of the plants that died at various moments of their growth indicated that the germination of the infected seed was reduced as compared with that of the controls, and that plants infected with both species of bunt died during their development. The percentage of death was not a constant figure and depended on the density of stand, on the time and depth of sowing, on the pathogen, and on the variety of wheat, the indica-

tions being that the less susceptible varieties (as judged by the number of plants infected) gave a higher percentage of deaths in relation to the number of infected ears. Although the immediate cause of the death of the infected plants still remains to be elucidated, an examination of the environmental conditions during the growth of the plants in the two years of the experiments leads to the suggestion that death was caused by interference with the transpiration of the infected plants. The author is inclined to attribute considerable economic importance to the mortality of the infected plants, as it may serve, as already noted by other investigators, to mask the losses caused by the disease, especially in drought years when the percentage of ears infected in the field may be very small even when the seed used is heavily infected and the weather during the time of sowing is favourable to infection. The reduction in the loss caused by bunt, in such years, is only apparent, since instead of bunted ears the disease leads to the premature death of the plants. It is also pointed out that in breeding work, the selection of resistant varieties on the percentage of infected ears, without taking into account the mortality in the plants, is not reliable.

The paper ends by a discussion of the modifications brought about by infection with bunt in other organs of wheat, namely, in the length of the ear rachis, in the number of spikelets, the shape and weight of the grains, and the suppression of awns in awned varieties.

DAVIS (R. J.). **Studies on Ophiobolus graminis Sacc. and the take all disease of Wheat.**—*Journ. Agric. Res.*, xxxi, 9, pp. 801–825, 6 pl., 5 figs, 1925. [Received March, 1926.]

A detailed account is given in this paper of investigations on the take all disease of wheat due to *Ophiobolus graminis.*

Three single spore strains of the fungus were used throughout the experiments, and are referred to as the 'New York', the 'Oregon', and the 'Arkansas' strains respectively. The varieties of wheat used (Goldcoin, California Club, and Marquis) all proved susceptible during the entire growing period, although more so at the seedling stage.

The New York strain formed perithecia, averaging about 300 μ in diameter, both in pure cultures and on wheat plants growing in inoculated soil. The ascospores germinated rapidly and sent out from 1 to 3 germ-tubes which branched and rebranched, forming a network of hyphae. No secondary sporidia were formed, nor were any conidial stages observed. Numerous cultures of this strain, made from single ascospores, produced perithecia and mature ascospores, showing it to be homothallic. No perfect fructifications were obtained from the other two strains under similar conditions or when grown together in mixed cultures. The New York strain was somewhat more pathogenic to wheat than the others.

Some variation was noted in the growth of the three strains at different temperatures, 19° to 24° C. being the optimum for the New York strain and 23° to 24° for those from Oregon and Arkansas. Light, while slightly checking the mycelial growth,

greatly stimulated sporulation. All three strains grew within a P_H range of 3·0 to 10, the optimum hydrogen-ion concentration being P_H 6·0 and 6·8 for the New York and Oregon strains, respectively, and between 6·8 and 7·6 for the Arkansas strain.

Experiments indicated that the fungus overwinters in plant refuse in the soil. Infection seldom occurs above soil level. The fungus enters the unbroken epidermis of the underground portions of the leaf sheaths, culms, and roots, often growing along the surface and forming a mat of hyphae before penetrating the tissues. There were indications that the cells are disorganized in advance of the growth of the mycelium.

McKinney (H. H.) & Davis (R. J.). **Influence of soil temperature and moisture on infection of Wheat plants by Ophiobolus graminis.**—*Journ. Agric. Res.*, xxxi, 9, pp. 827–840, 1 pl., 7 figs., 1925. [Received March, 1926.]

The authors considered that the conflicting opinions regarding the influence of soil temperature and moisture on the occurrence of foot rots of wheat were due to the fact that no specific foot rot had been studied from this point of view. They therefore carried out a series of experiments with *Ophiobolus graminis*, the cause of take all of wheat.

The experiments were conducted under greenhouse conditions at the Wisconsin Agricultural Experiment Station, Madison, with Goldcoin wheat, the methods being similar to those used in earlier studies on *Helminthosporium sativum* [see this *Review*, iii, p. 330]. For inoculation purposes, two strains of the fungus were obtained from Oregon and New York, respectively.

Disease manifestations were divided into three types: (1) leaf and stem blight; (2) infection of tiller bases; and (3) root infection. The severity and type of injury, together with the effect of different soil and air temperatures on infection, are given in tabular form.

The wheat seed germinated best at soil temperatures ranging from 12° to 20° C. and at soil moistures from 54·4 to 80 per cent. of the moisture-holding capacity. During the period of the experiments (20 to 31 days), the plants produced the greatest dry weight of the portions above ground at temperatures of from 20° to 28° and at soil moistures from 71·6 to 80 per cent. Soil temperatures of 16° to 26° appeared favourable for root development.

The optimum temperature for growth of the parasite was found to be 19° to 24° for the New York strain and 23° to 24° for that from Oregon. Infection of, and injury to, the wheat is favoured by moderately low temperatures (12° to 16°) and fairly high soil moistures (70 to 80 per cent.). Germination was not seriously affected and little injury was caused to the very young seedlings.

Somewhat similar temperature and moisture conditions favour the growth of the parasite and that of the host plant, while the development of the disease is favoured by a considerably lower temperature range. In many cases the plants can outgrow an attack, even when the root system has been severely damaged. Hence it is often difficult to detect the full extent of infection in the field.

PEYRONEL (B.). **La 'puntatura' dello scudetto nelle cariossidi del Frumento.** [The scutellum 'dot' of Wheat cariopses.]—*Boll. R. Staz. Pat. Veg.*, N.S., vi, 1, pp. 10–25, 1926.

A distinction is drawn between the so-called 'nerume' or 'nero' disease, characterized by black streaks and spots limited to the tufted end of the wheat grain, and the 'scutellum dot', a brownish-black discoloration of the scutellum which is of frequent occurrence in Italy and the cause of which has been much disputed.

Apart from the brown aureole on the seed coat over the embryo, no external symptoms are evident in the latter disease, and it has even been observed that the affected grain appears better nourished than the normal grain, and also weighs slightly more. The effects on germination vary. The results obtained by the author with the varieties Carlotta and Rieti 745, affected to the extent of 23·42 and 15·5 per cent., respectively, indicate that although the percentage of germination was slightly lower in the affected grain, the latter were more resistant to the grain moth *Sitotroga cerealella*.

The alteration in the seed coats, characterized by the brown discoloration, affects especially the layer of horizontal cells overlying the epicarp, but also involves the latter, and the tissues down to the aleurone layer, but not the embryo. In the brown area of the epicarp previous workers have reported the presence of brown hyphae of a fungus, and fructifications of *Cladosporium herbarum* were obtained when the affected grain was germinated, or fragments of the tissue placed in a moist chamber. The presence of this common fungus, however, does not, in the author's opinion, establish its causal relationship to the disease. His examination of typically discoloured kernels has shown only in very few cases the presence of *C. herbarum*. In many cases an olive-brown stromatic mass, with indications of the formation of pycnidia or perithecia, developed when the grain was placed under suitable conditions, with or without surface sterilization. It is concluded that *C. herbarum* is at least not invariably the cause of the disease.

Recent observations by the author indicate that the disease begins by a discoloration of the lodicules which are in close proximity to the scutellum. These are composed, at the base, of a swollen tissue of thin-walled cells, rich in nutriment, which collapses and dries up after the fertilization of the flower. At this stage these bodies form a particularly suitable substratum for the development of fungi, and hyphae may frequently be found in them and passing from them to the integuments over the embryo. It is possible that the rapidity of drying up of the lodicules may be the determining factor in the causation of the disease and may explain its varying incidence in different seasons.

It is stated that seed treatment with copper fungicides is practised in Sicily against this disease, and it is suggested that good results may follow the use of copper dusts for this purpose.

VOLK (A.). **Die Untersuchung des Saatguts auf Fusariumbefall.** [The examination of seed grain for *Fusarium* infection.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, vi, 1, pp. 2–3, 1 fig., 1926.

In this paper the author describes a new method for estimating the infection of cereal seeds by *Fusarium*.

Flower pots, 15 cm. high and 14 cm. in diameter, were placed in water for 10 minutes and then filled with sharp river sand, mixed with 10 per cent. of its own weight of water, to within 6 cm. of the top. The sand used was practically free from infection by *Fusarium*. For each experiment 100 seeds were distributed evenly on the surface, pressed down, and covered with 2 to 3 cm. of sand. The pots were then kept at 8° to 12° C. in a well lighted room, and the humidity maintained at 95 to 100 per cent. If the seed was found to be infected, 16 pots containing only 25 seeds each were taken in order to determine the exact percentage of infection. After 18 days the number of seedlings destroyed by the disease before they emerged from the soil was determined.

The method is stated to be cheap, quick, simple, easy to repeat, and to approximate closely to natural conditions. Field experiments, however, are still necessary for estimating the effect of the treatment of seed with disinfectants against *Fusarium* diseases as well as *Tilletia*.

Martin (W. H.). **Oats smut control studies.**—*Forty-fifth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1924*, pp. 390–392, 1925. [Received March, 1926.]

In a series of tests in the control of oat smut [*Ustilago avenae*] by ten different methods, the best results were obtained with the formaldehyde (1 in 40) sprinkle, the incidence of infection being reduced from 4·13 to 0·16 per cent. and the yield per acre increased from 24·6 to 25·1 bushels. Approximately equal results were also given by the formaldehyde spray (1 pint formaldehyde in 1 pint water) and the copper sulphate dip (10 minutes in a solution of 1 lb. $CuSO_4$, 1 lb. salt, and 5 galls. water, followed by 10 minutes in milk of lime, composed of 1 lb. stone lime in 10 galls. water). These methods reduced the incidence of smut to 0·32 and 0·28 per cent., respectively, and the yield in the former was increased to 25·9 bushels per acre. Nickel carbonate and copper carbonate dusts (2 oz. per bushel) also gave very satisfactory results, reducing infection to 0·22 and 0·85 per cent., respectively, and increasing the yield to 26·4 and 25·4 bushels per acre. Kalimat (30 minutes' immersion in a 0·25 per cent. solution), sulphur (4 oz. per bushel), and equal parts of dehydrated copper sulphate and lime (1 oz. per bushel) gave fairly good control, but the last-named reduced the yield.

Thomas (R. C.) & Tilford (P. E.). **Dust treatments for the control of Oat smut.**—*Ohio Agric. Exper. Stat. Bimonthly Bull.*, xi, 1, pp. 18–23, 2 figs., 1926.

The estimated loss due to the smuts of oats [*Ustilago avenae* and *U. levis*] in Ohio for 1925 was 4 per cent., as compared with 1·5 per cent. in 1924.

The results of preliminary trials in 1921, made with the object of finding a fungicide which would be available for use in the dust form for the control of oat smut, indicated that copper carbonate (which is giving promising results with wheat) could not be depended upon for oats. No single compound appeared sufficiently effective, and further trials were made employing a combination of

fungicides. These results indicate that while complete control is effected by the use of formaldehyde, combinations of copper sulphate, carbonate, or acetate, or of nickel carbonate, with mercuric chloride were reasonably effective and were definitely superior to copper and nickel compounds used alone. The results of experiments carried out in 1925 gave definite evidence of the satisfactory control obtained by using combinations of copper and mercury salts. For example, oats treated with a mixture of copper acetate and mercuric chloride (1 part of the former to 2 of the latter) gave only 0·2 per cent. smut, compared with 18 per cent. in the untreated seed.

Practical instructions are given for the application of the dusts. Three ounces will treat one bushel of grain. The use of some form of closed container, such as a rotary churn, is recommended for mixing the dust with the grain.

JONES (D. F.) & MANGELSDORF (P. C.). **The improvement of naturally cross-pollinated plants by selection in self-fertilized lines. 1. The production of inbred strains of Corn.**—*Forty-eighth Ann. Rept. Connecticut Agric. Exper. Stat.* (*Bull.* 266), pp. 348–418, 38 figs., 9 graphs, 1925. [Received April, 1926.]

The following observations in the section of this paper on susceptibility to disease (pp. 404–410) are of interest.

The most common diseases of maize in Connecticut are smut (*Ustilago*) [*zeae*], leaf blight (*Helminthosporium*) [*turcicum*], and various root, stalk, and ear rots due to *Diplodia* [*zeae*], *Gibberella* [*saubinetii*], and different forms of *Fusarium*. Marked differences in smut infection were shown in the selected lines, of which two (105–14 and 110–17) remained completely healthy during five generations [see also this *Review*, v, p. 224]. Eleven strains had only one plant infected in any one year during the same period. Some strains habitually showed the smut balls on the basal nodes, others at the ear nodes or on the leaves and tassels. The most striking case of segregation of parasitism by the smut fungus occurred in line 110–3. In the F_1 generation 4 per cent. of the plants were infected. In the F_2 three progenies of twelve plants each were grown. In one progeny there was no infection; in another all the plants were smutted and most of them killed; while in the third there was 27 per cent. of infection. The original seed of the two first progenies was replanted the following year, when the resistant line showed only 1·7 per cent. infection compared with 45·2 per cent. in the susceptible. In the next generation no smutted plants were seen in one line and 65·6 per cent. in the other. In the fifth generation the seeds of the susceptible line failed to germinate.

The selected lines of the fourth generation showed pronounced differences in their reaction to *Helminthosporium* in the abnormally wet season of 1922. Seventeen of the 86 lines showed heavy infection, some being prematurely defoliated, with stunting of the ears and under-development of the grain.

Outstanding differences in ability to stand erect and in freedom from moulds on the ears were observed in the third and subsequent

generations. In 1922 only one line (110–2) fulfilled both these requirements, though twelve were free from infection. This line had shown 4 and 10 per cent. of mould in the first and second generations, respectively. Another line, 105–20, showed 29, 17, and 44 per cent. infection in the second, third, and fourth generations, respectively; while 112–11 exhibited 67 per cent. of mouldy ears in 1922.

FAWCETT (H. S.). **Bark diseases of Citrus trees in California.**—*California Agric. Exper. Stat. Bull.* 395, pp. 3–61, 19 figs., 1925. [Received March, 1926.]

The bulk of this paper has been reprinted from *Bulletin* 360 [see this *Review*, ii, p. 542], but the following diseases are newly described.

Dry rot, associated with the presence of different species of *Fusarium*, is characterized in the early stages by a soft, damp rot producing an abnormally dark coloration of the wood. Later the affected areas turn light brown and the texture of the bark becomes firm. The decay may involve a large part of the woody cylinder of the root and acts indirectly on the aerial system of the tree, which is characterized by a yellow discoloration and dropping of the foliage and the production of an abnormally large crop of fruit. Of the various physiological predisposing causes of the disease, excessive soil moisture at the base of the tree is thought to be the most important. Inoculation experiments with the above-mentioned species of *Fusarium* gave negative results. In the early stages of the disease infection may be arrested by the excision of the decayed tissue, followed by the application of mercuric cyanide or mercuric chloride (1 in 500) or Arrow carbolineum and, somewhat later, by that of thick asphalt paint or tar. Thorough drainage and root aeration are important.

Root rot, caused by *Armillaria mellea*, is stated to be prevalent in certain localities where oaks have been replaced by citrus trees [see this *Review*, v, p. 37]. The disease is frequently accompanied by gumming near the base of the trunk. The death of affected trees usually occurs in one to four years. The spread of the fungus may be checked in mild cases by digging trenches round the infected trees and adopting the usual sanitary measures. Good results have further been given by the application to the soil, before replanting, of 1½ oz. carbon bisulphide poured into holes 1½ ft. apart and 1½ ft. deep.

A form of gummosis similar to that caused by *Diplodia* on lemon trees has been shown by recent experiments to be due to a fungus resembling *Botryosphaeria ribis* [see this *Review*, iv, pp. 178, 636], which also causes a rot of the fruit. Gum is exuded in large quantities from pockets in the trunk or large limbs. The inner bark tissue is often disintegrated and dissolved, leaving elongated cavities in the region adjacent to the cambium. The affected tissues are of a chocolate-brown colour. There is also a gummous zone near the cambium, similar to that produced by *Botrytis cinerea* and *Pythiacystis citrophthora* [see this *Review*, ii, pp. 539, 542].

The most striking symptom of blast (*Pseudomonas citriputeale*) [see this *Review*, ii, p. 392; iii, p. 523] is stated to be the develop-

ment of a brown to black area, usually starting in a tear or break of the wing of the petiole and rapidly extending into the leaf blade and to the twig at the base of the petiole. There is a definite line of demarcation between living and dead tissue; new callus forms under the affected areas; and the initial black colour changes to reddish-brown, while scabs are produced on the dry bark. Girdling of the twigs may occur in exceptionally severe attacks. The bacteria are most abundant in the layers near the cambium, the parenchyma being chiefly attacked. At high or medium temperatures there may be some gum formation. The 'black pit' form of the disease occurs on lemons as sunken, brown, later black, spots, the inner white part of the peel also being affected. The tissues collapse and turn light to reddish-brown. The results of five years' spraying experiments indicate that injury from this disease is largely preventable by the application of Bordeaux mixture in November, combined with proper cultural methods.

Savastano (L.). **Sulle cause aggravanti il mal secco negli agrumeti del versante orientale della Sicilia.** [On the causes aggravating 'mal secco' in the Citrus groves on the eastern slopes of Sicily.]—*Boll. R. Staz. Sperim. di Agrumic. e Fruttic. Acireale*, 54, 7 pp., 1 fig., 1926.

'Mal secco' [see below, p. 368] is stated to be prevalent in the citrus plantations in the east of Sicily and is especially serious in the lemon groves. Its earliest record in Sicily dates back to 1861 (when it was termed 'mal della gomma'), but it was not brought to notice again until a few years ago [when the author attributed it to *Pseudomonas citriputeale*: see this *Review*, iii, p. 523], apparently because in the meantime the practice of grafting lemons on the bitter orange, which is not susceptible to attack, had become general. The reappearance of 'mal secco' in recent years is attributed to the modern use of citron stocks, and to a newly-introduced method of irrigation adapted to the summer-ripening 'verdello' lemon, in which no water whatever is given in the early half of the summer, but the groves are then heavily irrigated.

The control measures recommended by the author are limited to the improvement of cultivation and manurial methods, especially the free use of farmyard manure, and the pruning off of all infected branches at an early stage of the disease. In severely diseased areas it is better to abandon lémon growing and put the land under market garden crops for a time.

Cook (M. T.) & Dozier (H. L.). **Spraying Citrus fruits in Porto Rico.**—*Porto Rico Insul. Exper. Stat. Circ.* 88, 23 pp., 5 figs., 1925. [Received April, 1926.]

The most important fungous diseases of citrus trees in Porto Rico are stated to be scab (*Cladosporium* [*Sporotrichum*] *citri*); greasy spot or false melanose, which is responsible for a conspicuous brown or black spotting of the under side of the leaves; melanose (*Phomopsis citri*); anthracnose or wither-tip (*Colletotrichum gloeosporioides*); stem-end rot and die-back (*P. citri* or *Diplodia natalensis*); and tear-stain (*P. citri, C. gloeosporioides*, or the rust mite, *Phyllocoptes oleivorus*). Brief notes are given on the symptoms of

each of these diseases, and full directions are added for their control by sanitary measures and spraying with Bordeaux-oil emulsion, which should be applied weekly in rainy seasons and at 10- to 14-day intervals in dry ones [see this *Review*, ii, p. 363]. The circular further contains a number of useful hints on equipment, materials, and the preparation and application of the mixture.

HAWKINS (L. A.) & BARGER (W. R.). **Cold storage of Florida Grapefruit.**—*U.S. Dept. of Agric. Bull.* 1368, 6 pp., 1926.

Investigations on the storage of Florida grapefruit were begun in 1917. Experimental work showed that fruit held in cold storage for six weeks to two months showed a tendency to become covered with sunken brown spots. The method adopted for the control of this trouble (known as 'pitting') was to 'cure' the fruit by exposure to a temperature of 65° to 80° F., with a relative humidity of 55 to 65 per cent., for one to two weeks. The testing of this process on a commercial scale started in 1922. The fruit used was of different varieties, including Duncan, Silver Cluster, and Walters.

In the first experiment 343 crates of fruit picked on 27th and 28th March, 1922, were exposed for 13 days to a temperature of 67° to 85° (average 75°) with a relative humidity of 38 to 98 (average 65) per cent. The loss in weight from shrinkage was 3·9 per cent. Sixty boxes were inspected when the fruit was packed. The average decay from blue mould [*Penicillium digitatum* and *P. italicum*] was 1·8 and that from stem-end rot [*Phomopsis citri* or *Diplodia natalensis*] 1·1 per cent. The merchantable fruit, amounting to 231 boxes, was shipped, after precooling, to Arlington (Virginia) and placed in storage at 32°. The first lot of 100 boxes was sold on 2nd to 6th June, when there was found to be 9·6 per cent. decay in the first-grade fruit, 5 per cent. in the second, and 13·7 per cent. in the third. In a second lot sold on 17th June the corresponding amounts of decay were 14, 5·5, and 14 per cent., respectively. In the last lot, sold on 6th and 7th August, the decay amounted to 37·5 per cent. in the first grade, 36 in the second, and 44 in the third, with a considerable proportion of pitted fruit. This fruit, and some kept till September, was edible, but broke down rapidly at ordinary market temperatures. The fruit fetched $6·50 per box compared with $3 to $3·50 at the beginning of storage.

The second car of grapefruit, picked between 8th and 15th January, 1923, arrived at Washington on the 25th, when some was cured at packing-house temperature for a week, and others exposed to kerosene-stove gas for 24 to 63 hours, before storage at 32°. Five weeks after storage, when 200 boxes were sold, there was hardly a trace of decay in the first-grade fruit, 0·92 per cent. in the second, and 0·47 per cent. in the third. On 14th March there was less than 1 per cent. decay in any of the lots, but some pitting.

In the third experiment, fruit picked on 10th April, 1923, was cured in packing-house air for four days, a two-burner kerosene-stove being used at night. The temperature range was 79° to 84° and the relative humidity 47 to 73 per cent. The loss in weight

was 1·6 per cent. The fruit showed 4 to 5 per cent. decay on arrival at Arlington, where it was stored at 32°. After six weeks in storage the total amount of decay from stem-end rot and blue mould was 4·3, 3·98, and 8·15 per cent. in the first, second, and third grades, respectively. The corresponding figures a week later were 3·39, 2·98, and 14·3, while the first and second grades showed 4·4 per cent. bad pitting and the third grade 10·5.

It was ascertained that considerably less decay occurs in fruit from which the 'buttons' have been removed [see this *Review*, iii, p. 35], especially after a month's storage.

In the course of these investigations, a number of car loads of uncured fruit was examined. In one car load kept in cold storage for eight weeks 48 per cent. of pitting was found in the second-grade fruit and 28 per cent. in that of the first grade. Similar conditions were observed in another lot stored for about the same period.

NARASIMHAN (M. J.). **Stamping out the koleroga of Areca.**—*Mysore Agric. Calendar*, pp. 25, 28, 1926.

Since 1912, when preventive measures against koleroga of areca nuts (*Phytophthora*) [*arecae*: see this *Review*, iv, p. 655] were first instituted, the virulence of the disease has been very considerably mitigated, but complete eradication appears to present insurmountable difficulties, except in absolutely isolated areas. Where the gardens cover large blocks of 40 to 60 acres, failure to spray on the part of a few small holders may greatly increase the severity of the disease. Infection is further perpetuated by a number of common weed hosts of the fungus, e.g., *Bryophyllum calycinum* [loc. cit.]. In view of these obstacles to the extermination of the disease, the adoption of a regular spraying schedule offers the only chance of reducing the annual losses due to the fungus. The total number of gardens sprayed during 1925 was 1,015, covering an area of 6,602 acres.

VENKATARAYAN (S. V.). **Black rot or koleroga of Coffee and its control.**—*Mysore Agric. Calendar*, pp. 37, 40–41, 1 pl., 1926.

A brief description is given in popular terms of the black rot or koleroga disease of coffee (*Corticium koleroga*), which is stated to be often responsible for annual losses of 25 to 50 per cent. of the crop on estates situated in the wetter districts of Mysore. Directions are given for the preparation and application of Bordeaux mixture with casein adhesive, and some particulars regarding the cost of the spraying operations [see this *Review*, iv, p. 540] are furnished.

McNAMARA (H. C.). **Behavior of Cotton root rot at Greenville, Tex., including an experiment with clean fallows.**—*Journ. Agric. Res.*, xxxii, 1, pp. 17–24, 4 figs., 1926.

The present paper is a preliminary report of the observations made from 1919 to 1924 at the Cotton Breeding Field Station at Greenville, Texas, regarding the annual spread of the cotton root

rot disease, *Phymatotrichum (Ozonium) omnivorum* [see this *Review*, iii, p. 134]. Each year the infested areas were carefully mapped to show the distribution of the disease in each cotton row, as indicated by plants that died before the setting in of frosts. The records show that during the period from 1921 to 1924 the disease advanced quite regularly, and suggest that the annual spread was approximately equal to the width of the annual border ring, averaging about 10 ft., the appearance of which was, however, much more distinct in some seasons than in others. Inside the border ring of dead plants there may occur a distinct zone where many of the plants, or even a majority, may survive, this inner ring roughly corresponding to the outer zone of the previous year, where all the plants had died. In general, the direction of spread appeared to be outwards.

The results of an experiment [some details of which are given], in which two heavily infected plots were kept free from all plants, the first for one year and the second for two years, indicated that an absolutely clean fallow during two years may prove to be a means of control of the disease, as the second plot showed no dead plants or evidence of foot rot on being replanted with cotton after the fallow. The first plot, which showed dead plants on 64·4 per cent. of its surface in 1921, had its infected area reduced to 21·6 per cent. in 1923, after the one-year fallow, this figure being further reduced to 17·4 per cent. in 1924, the second year after the fallow.

MORRIS (L. E.). **I. Mildew in Cotton goods. The growth of mould fungi on sizing and finishing materials.**—*Journ. Text. Inst.*, xvii, 1, pp. T1–T22, 1 pl., 1926.

In continuation of the studies on the development of mildew caused by moulds growing on cotton goods [see this *Review*, iv, p. 280], the author studied the relative liability of the more important sizing and finishing raw materials to induce damage from mildew.

A brief survey of other investigations on this subject is followed by a short account of the source and biochemical characters of certain of the substances investigated, the distinctions between cassava flour, cassava starch, and tapioca being especially indicated.

The following species of mould fungi, isolated from cotton goods mildewed under ordinary trade conditions, were selected for testing: *Aspergillus flavus* and *A. niger*, *Cladosporium herbarum*, *Rhizopus arrhizus*, two species of *Penicillium*, and one of *Fusarium*. In each case the rate of growth on the different sizing and finishing substances was determined, and also the time necessary for sporulation.

The results indicate that the dextrins, and also wheat, rice, and cassava flours, permit the most rapid growth and production of spores, especially the latter group. An intermediate group is formed by wheat and maize starches, gum tragacanth, and soluble starch. Tapioca flour (cassava starch), sago, and farina are stated to be least liable to allow of the development of mildew. In general, growth is favoured by the presence of sugars and nitrogenous material.

Morris (L. E.). **II. Mildew in Cotton goods. The growth of mould fungi on steeped Wheat flour.**—*Journ. Text. Inst.*, xvii, 1, pp. T23–T37, 4 figs., 1926.

The growth characters of the seven species of mould fungi referred to in the previous paper [see last abstract] and also another, greyish-green, species of *Aspergillus*, isolated from grey cloth, were studied on hard and soft wheat flours, which had been steeped for different periods. The practice of steeping such flours prior to their use in sizing is stated to be customary. If preservatives are not added fermentation occurs in the flour.

The results, as a whole, confirm the general opinion in the industry that a period of fermentation decreases the liability of the flour to develop mildew. This, however, was found to vary according to the species involved. The growth of *Cladosporium herbarum* and *Fusarium* is increasingly checked as the steeping period is lengthened. On the other hand, steeping has little or no effect on the growth of *Aspergillus* and *Penicillium*, which are responsible for the greater proportion of cases of mildew in sized goods.

Similar specific differences were shown when the flours were steeped with the addition of 6 per cent. zinc chloride as an antiseptic. This checked the growth of the fungi, but its action on *A. flavus* was only one-seventh of that on *C. herbarum*. In this case the duration of steeping did not affect the result.

Neutralizing the fermented flour by the addition of caustic soda increases the liability to mildew, as does also, but to a less extent, removal of the acids by washing. Washing also counteracts the effect of adding zinc chloride. With unsteeped flour, however, washing decreases the liability to mildew.

The beneficial effect of steeping is probably largely due to the toxic action of the acid products of fermentation on the fungi. Washing eliminates acids, though it also removes some of the nutrient substances on which the fungi feed.

Ota (M.). **Sur quelques champignons pathogènes du type Trichosporum beigeli Vuillemin.** [On certain pathogenic fungi of the type, *Trichosporum beigeli* Vuillemin.]—*Ann. Parasitol. Humaine et Comp.*, iv, 1, pp. 1–13, 3 figs., 1926.

The cultural and morphological characters of the following fungi pathogenic to man: *Mycoderma cutaneum, Parendomyces astéroides, P. balzeri, Trichosporum beigeli,* and *Hemispora rugosa* are described. All were found to be practically identical in microscopic characters whether cultivated on solid or in liquid media. Yeast-like forms predominate in culture, but oidial forms were but little less frequent. Pseudoconidia budded off laterally from the mycelium, and chlamydospores formed in the course of the hyphae, also occur. All stages of transition between the yeast-like and oidial forms and forms with more or less regular hyphae are figured. Still the author states that it is possible to distinguish each species by certain characters of growth and propagation which are briefly defined. He considers that they should all be referred to the genus *Trichosporum* as *T. cutaneum, T. asteroides, T. balzeri, T. beigeli,* and *T. rugosum*. This genus is considered to be closely related to *Mycoderma* Persoon.

Ota (M.) & Gaillard (H.). **Sur une teigne trichophytique d'un bovidé du Cameroun produite par une espèce nouvelle de Grubyella, G. camerounensis n. sp.** [On a trichophytic ringworm of a Cameroon bovine caused by a new species of *Grubyella*, *G. camerounensis* n. sp.]—*Ann. Parasitol. Humaine et Comp.*, iv, 1, pp. 14–21, 3 figs., 1926.

Cultures isolated from a ringworm on a bull brought to Paris from the Cameroons were found to correspond closely to those of *Grubyella alba* and *Bodinia glabra* (*Trichophyton album* and *T. glabrum*), especially to the former. In view of slight differences in the microscopic characters it has been named *G. camerounensis* n. sp.

The hyphae are 4 μ broad, septate, and frequently branched. Stalked chlamydospores are abundant, 15 to 20 by 10 to 15 μ in diameter, thick walled, and formed by an enlargement of the tip of the branches. These sometimes assume an irregularly contorted form. Laterally borne chlamydospores, resembling conidia, are also found, but true conidia or aleuriospores are absent. Chains of arthrospores occur in large numbers, the cells being rectangular or rounded and 6 to 12 μ in diameter. Some of these have a certain resemblance to the spindle-shaped spores of other dermatophytes.

Heyderdahl (S. A.). **Actinomycosis of the face and neck treated with radium.**—*Brit. Journ. of Radiology*, xxxi, 306, pp. 1–14, 4 pl., 1926.

The author reports the clinical history and results of treatment of 21 cases of 'actinomycosis faciei' and 'colli' [? due to *Actinomyces bovis*] exposed to the action of radium at the Riks [State] Hospital, Oslo, Norway, between 1913 and 1923. In all cases the diagnosis was confirmed by microscopic examination. In the majority of cases gamma rays from concentrated preparations of radium were employed, the rays being filtered through 1 to 2 mm. of lead. The results were uniformly successful, and no relapses have been reported to date.

Miescher (G.). **Untersuchungen über das Vorkommen wachstumsfördernder Wirkungen nach Radiumbestrahlung an menschenpathogenen Hyphomyzeten.** [Investigations on the occurrence of stimulatory effects on the growth of human pathogens (Hyphomycetes) as a result of radium radiation.]—*Fortschr. auf dem Gebiete der Röntgenstrahlen*, xxxiii, 1, pp. 81–85, 1 diag., 1925.

The writer conducted a series of experiments in which cultures of the dermatophytes *Trichophyton gypseum* and *Achorion gypseum* were exposed to the action of radium rays of varying intensity for different periods. In no case was any stimulatory effect on growth observed; on the contrary, prolonged exposure to the rays tended to retard and finally to suppress development.

Bardelli (P. C.). **E' possibile vaccinare preventivamente contro la linfangite criptococcica? Nota preventiva.** [Is preventive inoculation against epizootic lymphangitis possible? Preliminary note.]—*Ann. d' Igiène*, xxxvi, 1, pp. 36–38, 1926.

In connexion with a study on epizootic lymphangitis of the

horse, the writer carried out the following experiments on two horses: (1) was inoculated three times, at intervals of ten days, with 0·005, 0·01, and 0·02 gm., respectively, of Rivolta's *Cryptococcus* [*C. farcinimosus*: see this *Review*, iv, p. 478]; in the case of (2) cultures of the human parasites, *Monilia macroglossiae* and *M. castellanii* [see this *Review*, v, p. 98] were substituted for *C. farcinimosus*. A month after the last inoculation both animals received three injections, at intervals of 14 to 16 days, of 0·08 gm. of a strain of *C. farcinimosus* isolated in October, 1923.

A purely local and transitory reaction was produced in (1) by each of the above-mentioned injections of *C. farcinimosus*. Further injections, in which the dose was successively increased to 0·16 and 0·20 gm., were ineffective. In (2), on the other hand, the typical symptoms of epizootic lymphangitis developed after an incubation period of 31 days.

It is possible, therefore, to confer a high degree of resistance to epizootic lymphangitis, under experimental conditions, by inoculation with *C. farcinimosus* (one strain of which has been shown to retain its virulence for over two years). It remains to be seen whether this treatment is equally efficacious in animals exposed to natural infection.

PECKHAM (JANE F.). **Study of yeasts from human sources.**—*Journ. Infect. Dis.*, xxxvii, pp. 53–61, 1925.

Fifty-one cultures of yeasts from throat infections, bronchitis, stomatitis, and vaginitis were identified as follows: 45 were species of '*Monilia*' [? *Candida*, see this *Review*, iii, p. 556] of which 38 were pathogenic to rabbits and guinea-pigs; five belonged to the genus '*Oidium*' [? *Oospora*], of which three were pathogenic; and one to *Saccharomyces* (non-pathogenic). Yeast 45, representing the pathogenic type, most closely resembles *M. pinoyi* (Castellani 1910), from which it differs, however, in the production of acid in galactose and saccharose. The cells are round and 5 to 6 μ in diameter, or oval and 4 to 5 by 8 to 12 μ. The elliptical forms give rise to a few septate hyphae on solid media and to many in liquid. Lateral and terminal chlamydospores are formed in old liquid cultures.

This organism, injected into animals, caused lymphopenia; induced the formation of antibodies; was toxic in systemic effect; and produced localized lesions characterized by necrosis, by an infiltration of endothelial cells fusing to form giant cells, and by a proliferation of fibroblastic tissue which is very marked in the pancreas.

From the effect of yeasts on the blood and tissues of animals, it is concluded that they may become additional etiological factors in infections primarily due to other organisms.

BRENTZEL (W. E.). **The pasmo disease of Flax.**—*Journ. Agric. Res.*, xxxii, 1, pp. 25–37, 5 pl. (1 col.), 1 fig., 1926.

The disease of flax and linseed caused by *Phlyctaena linicola*, and known in South America under the name of 'pasmo', is stated to have been probably introduced some ten years ago into the

United States [see this *Review*, iii, p. 265] with imported seed. During the past three years it has been observed on seed flax at various points in North and South Dakota, Minnesota, and Michigan. Its symptoms in the United States appear to be identical with those described from the Argentine by Spegazzini (*An. Mus. Nac. Buenos Aires* (III), xiii, 1911) and Girola (*An. Soc. Rural Argentina*, liv, 1920).

In the field the disease usually becomes apparent a short time before harvest in the form of scattered, brown areas that gradually enlarge. The plants at the margins of such patches are but slightly affected, while towards the centre many of the plants are completely defoliated, and the stems are brown and dry. Lesions develop first on the cotyledons and later on the other leaves, which may wither and fall or sometimes curl and remain attached. They are more or less circular in outline, varying in colour from greenish-yellow in the early, to dark brown in the advanced stages. On the stems the lesions develop first on the lower portions as somewhat elongated spots, and extend only partly around the stem. Later they occur on all parts of the stems and girdle them, extending longitudinally for several centimetres. At this stage the infected portions alternate with irregular bands of uninfected green portions, this giving the stems and pedicels a characteristic mottled appearance. In diseased plants many of the seed capsules fail to fill or develop only shrivelled seed, but when the disease appears late in the season the yield in seed may not be much reduced. In severe attacks flax grown for textile purposes may be much damaged.

The pycnidia of the causal fungus, which develop abundantly on all the organs infected, are submerged, lens-shaped, largely incomplete, in the early stages, but later almost complete, with small ostioles, and about 63 to 126 μ in diameter. The pycnospores are hyaline, subcylindrical, tapering slightly at the ends, straight, curved, or angularly bent, usually 3-septate, and 21·7 by 2·8 μ in diameter. In culture the fungus developed well at temperatures ranging from 17° to 29° C., the optimum temperature for mycelial growth being about 21°, while at 5° and 32° there was very little growth.

Parallel inoculation experiments indicated that *Phlyctaena linicola* is a much weaker parasite than *Colletotrichum linicolum* [*C. lini*: see this *Review*, iv, p. 219]. Under average conditions it appeared scarcely more than able to maintain itself on young, green flax plants, but later, when the plants begin to flower and develop seed, the disease becomes virulent and spreads rapidly. The lower areas of a field are usually the most severely attacked.

Experiments conducted during the past two years indicate the existence of a wide range of varietal resistance to the disease in flax and linseed. The most susceptible were selections of the Argentine type, the commercial varieties of linseed—North Dakota Resistant No. 52, North Dakota Resistant No. 114, and North Dakota No. 155—being much more resistant. A few hybrids, grown in experimental plots, appeared to be almost entirely immune.

In the author's opinion, the disease should be easily controlled in farm practice by seed disinfection with formaldehyde, burning

the infested straw, and crop rotation, since the fungus overwinters on the remains of the previous crop and viable spores were also found on the seed.

Esmarch (F.). **Blattfall bei Azaleen.** [Leaf fall of Azaleas.]—*Die Kranke Pflanze,* iii, 2, p. 41, 1926.

Considerable damage is stated to be caused in Saxony by the fungus *Septoria azaleae*, which produces yellow or reddish-yellow spots on the leaves of azalea plants. Diseased individuals should be isolated and healthy adjacent plants sprayed with Bordeaux mixture. Fallen leaves should be collected and burnt.

Nicolas (G.). **Un exemple nouveau et certain de parasitisme chez les Hépatiques (Marchantia polymorpha L.).** [A new and undoubted instance of parasitism in Liverworts (*Marchantia polymorpha* L.)]—*Comptes Rendus Acad. des Sciences,* clxxxii, 1, pp. 82–83, 1926.

A sterile thallus of *Marchantia polymorpha*, collected in February 1925 in a withering condition and with a metallic, bluish-grey discoloration of the fronds, was found by the author to harbour two fungi, a mycorrhizal fungus localized in the lower portion of the thallus, and a second invading the cells between the tissues occupied by the former and the chlorophyll-containing tissue. In some cells the latter fungus formed either single terminal or catenulate intercalar sporocysts in short chains, 10 to 15 by 8 to 10 μ in diameter, separated from the mycelium by a septum. Besides these bodies, four oospores, 12 to 13 μ in diameter, were found in the *Marchantia* thallus. All the starch in the host tissues was digested by the fungus, except at the apex, which was not invaded. Attempts to culture the fungus in artificial media gave negative results.

The presence of sporocysts arising directly on the vegetative hyphae, and of oospores, leads the author to refer the fungus to *Pythium*. It differs from *P. de Baryanum* by its intercalary sporocysts in chains, and by the smaller size of the oospores, but the author suggests the possibility of its being a specialized strain of *P. de Baryanum*.

Davis (W. H.). **Life history of Ustilago striaeformis (Westd.) Niessl which causes a leaf smut in Timothy.**—*Journ. Agric. Res.*, xxxii, 1, pp. 69–76, 1926.

This is a brief account of the experiments at the Massachusetts Agricultural Experiment Station in an attempt to establish the life-history of *Ustilago striaeformis*, the cause of leaf smut of timothy grass (*Phleum pratense*), some details of which were given by the author in a previous communication [see this *Review*, iii, p. 742]. The results indicated that the germ-tubes of the germinated smut spores from timothy do not penetrate the meristematic tissues in the leaves, stems, and floral organs of the host, and that infection of the seed seldom, if ever, occurs from the smut mycelium advancing from infected culms into the floral parts. Inoculation experiments on timothy seedlings showed that seedling infection is of common occurrence, and that the seedlings were most susceptible to infection

when the coleoptiles were from 1 to 10 mm. in length; when the coleoptiles were 16 or more mm. long, no infection occurred.

Under the local conditions *U. striaeformis* is stated to overwinter both as perennial mycelium in the bulb-like bases of the timothy plants, and as spores in the soil or in decaying smutted plants left in the field. In the spring the perennial mycelium may invade the new leaves and floral parts soon after or during their formation, thus producing a systemic disease. The spores in the soil pass through an after-ripening period of approximately 250 days, after which they retain their germinability for about 72 days. In the author's experiments, the smut spores did not remain viable in soil for two years.

SAVASTANO (L.). **La cura del mal secco negli alberi fruttiferi.** [The control of 'mal secco' in orchard trees.]—*Boll. R. Staz. Sperim. di Agrumic. e Fruttic. Acireale*, 51, 15 pp., 3 figs., 1925.

This is a popular account of the four types of disease, attributed by the author to bacteria, in Sicilian orchard trees (including citrus, apricot, peach, pear, loquat, mulberry, olive, fig, pomegranate, chestnut, and walnut), on which the author published a more detailed paper in 1923 [see this *Review*, iii, p. 523]. Particular attention is given to the description of the bacterial wilt ('mal secco') and its distinction from the other orchard troubles with which it may be confused. The disease can only be checked at a very early stage. Annual pruning, for which practical instructions are given, is effective in limiting its progress, but where the disease has reached an advanced stage the eradication of the trees is necessary. Inadequate manuring and irrigation are considered to be largely responsible for the diseased condition.

ROSEN (H. R.). **The number and arrangement of flagella of the fire blight pathogen, Bacillus amylovorus.**—*Mycologia*, xviii, 1, pp. 23–26, 2 pl., 1926.

The author states that pure cultures of bacteria isolated by him in 1924 and 1925 from apples exhibiting typical symptoms of fire-blight, and subjected to a flagella stain developed by him (a description of which is to be published elsewhere), showed rods with only single, polar flagella, while showing all the other characteristics of *Bacillus amylovorus*. Inoculation with these cultures produced typical symptoms of fireblight in pears. The bearing of the discovery, if confirmed, on the systematic position of the organism is briefly discussed, and it is pointed out that the generic name will require to be changed to either *Pseudomonas*, *Bacterium*, or *Phytomonas*, according to the system of nomenclature followed.

FUKUSHI (T.). **Studies on the Apple rust caused by Gymnosporangium yamadae Miyabe.**—*Journ. Coll. of Agric., Hokkaido (Japan) Imper. Univ.*, xv, 5, pp. 269–307, 4 pl., 1925. [Received April, 1926.]

Of the fifty apple varieties inoculated with *Gymnosporangium yamadae* Miyabe [see this *Review*, ii, p. 237], Fameuse and McIntosh were found to be resistant to the rust. Minute spermogonia were

produced, but no aecidia developed throughout the season. Mycelial growth was found to be restricted to the leaf tissue immediately beneath the abnormally small spermogonia, and did not extend so widely as in normal infections.

The optimum temperature for the germination of the teleutospores ranges from 16° to 22° C., with a maximum and minimum of 30° and 7°, respectively.

The aecidiospores of *G. yamadae* can only with difficulty be induced to germinate during the season in which they are produced, while those of the pear rust, *G. haraeanum* Syd. (*G. asiaticum* Miy.), germinate readily under similar conditions. The germinability of the aecidiospores of *G. yamadae* was retained for periods of 177 and 212 days in the writer's experiments.

The basal portion of the leaf trace bundle is involved in the early stages of development of the gall produced by this fungus on *Juniperus chinensis*. The parenchyma composing the greater part of the gall is formed by the medullary ray cells and the bast parenchyma cells of the stem, stimulated to abnormal growth and accelerated division. The fungous mycelium, with its binucleate cells, is found throughout the gall tissue, except in the cork layers. It does not usually extend far into the stem in either direction beyond the base of the gall.

WICKENS (G. W.). **Apple scald.**—*Journ. Dept. of Agric. Western Australia*, 2nd Ser., ii, 4, pp. 492–493, 1925.

A series of experiments was carried out to test the value of prepared wrappers in the control of scald on Granny Smith apples, four cases of which were kept in cold storage at an average temperature of 33° [F.]: (1) was wrapped in 'anti-scald' paper (Kalamazoo Vegetable Parchment Co., Michigan, U.S.A.); (2) in another American production known as the 'coronite mineral oil fruit wrapper'; (3) in sulphite tissue paper; and (4) unwrapped. The fruit was examined on 1st October, 1925, after approximately four months in storage. On unwrapping the fruit the only noticeable difference was the somewhat more attractive appearance of the apples in (1); within 24 hours, however, scald began to develop in the fruit from (4) and to a lesser extent in (3). On 10th October nearly all the 106 apples in (4) and 53 out of 106 in (3) were affected, while the incidence of scald in (1) and (2) was negligible.

It was observed that a number of the affected apples showed symptoms of scald round the calyx. Nine out of twelve apples from case (3) allowed to remain in the paper on removal from storage developed scald round the calyx, and some of these were also affected elsewhere.

MORSE (W. J.) & FOLSOM (D.). **Apple spraying and dusting experiments 1918 to 1924.**—*Maine Agric. Exper. Stat. Bull.* 325, pp. 125–184, 3 charts, 1925. [Received March, 1926.]

During the period under review, spraying and dusting tests with various fungicides against apple scab [*Venturia inaequalis*] were carried out at Highmoor Farm, Monmouth, Maine. These tests were in continuation of previous observations, started in 1910 on the same area. Details are given of each year's experiments, those of

1922 to 1924 being illustrated by charts, and the results are given in tabular form and discussed in relation to those obtained in other apple-growing regions of America.

The conclusion drawn from 6 years' results (there being no spraying in 1920) is that lime-sulphur, either dry or liquid, used alone or with lead arsenate in 3 to 5 applications beginning at the pink stage, gives the best control of scab under local conditions. A combination schedule of lime-sulphur for the first application, followed by lead arsenate alone for the remaining two, gave a high percentage of smooth fruit. Bordeaux mixture (2–2–50 or 2–10–50) did not give good control of the disease and caused fruit russeting.

Control by lime-sulphur was found to be possible even when the first spraying was given after the ascospores had begun to be discharged and had caused some infection of leaves and buds at the pre-pink stage. The amount of scab occurring in previous seasons appeared to have no effect on control.

The use of a casein spreader for lime-sulphur applications increased leaf burning and was unnecessary for good control. Spraying caused more leaf fall, fruit dropping, and russeting than dusting with sulphur-lead arsenate dust, but gave, on the whole, better control of scab.

Taking an average from the 14 years, May 19 is given as the date for the pink application, and June 4 for the calyx application. Untreated plots gave an average of 50 per cent. scab during this period, against 8 per cent. on plots showing the best control by lime-sulphur spraying.

In view of the fact that, during wet seasons, 3 applications only of lime-sulphur often proved unsatisfactory, from 4 to 5 are considered more profitable.

Less scab injury occurs in Maine than in many other apple-growing regions, probably owing to the more favourable climatic conditions of the State.

BREMER (H.). **Ausbaumöglichkeiten in der Pflanzenschutzstatistik. (Beispiel: Die Beziehungen des Apfelfusikladiums zum Wetter.)** [Possibilities of development in plant protection statistics. (Example: the relations between Apple *Fusicladium* and the weather.)]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, vi, 1, pp. 1–2; 2, pp. 12–13, 1926.

In connexion with a general discussion of the correlation between meteorological conditions and the incidence of plant diseases, the phenological data on apple scab (*Fusicladium*) [*Venturia inaequalis*] presented in an earlier paper [see this *Review*, iii, p. 458] are recapitulated. Suggestions are made for various developments in the present method of collecting plant protection statistics, especially in regard to the correlation between the incidence of scab and the amount of rainfall during the ten days previous to blossoming.

WAITE (M. B.) & SIEGLER (E. A.). **A method for the control of crown gall in the Apple nursery.**—*U.S. Dept. of Agric. Circ.* 376, 8 pp., 8 figs., 1926.

The problem of crown gall (*Bacterium tumefaciens*) control in

the root-grafted apple nurseries of the United States is very serious, losses of 25 to 50 per cent. being common, while in very severe cases 95 per cent. of the trees may be attacked. Riker's and Keitt's theory that the disease is not responsible for malformations in rejected nursery stock [see this *Review*, v, p. 83] has not been borne out by the writers' investigations.

In 1909 the senior writer demonstrated the practicability of control by the immersion of stocks and scions in a formaldehyde solution before grafting. Further experiments carried out since 1921, when the need for more exact information on the subject of control became pressing, have confirmed the value of this treatment. For the past three years an organic mercury compound (hydroxymercurichlorophenol, known commercially as semesan) has also been tested with even more satisfactory results. Of the 2,619 grafts treated with the latter preparation in 1925, only 6·1 per cent. showed infection at digging, compared with 32·6 per cent. on the same number of untreated grafts. The proportion of large galls was 2 per cent. in the treated and 28·7 per cent. in the controls.

Directions are given for the control of the disease by seedling selection; ten minutes' immersion of seedlings and scions in semesan (1 in 400, or approximately 1 oz. to 3 galls.); five seconds' immersion of the grafts, wrapped in raffia or muslin, in the same solution; storage of grafts under cool conditions and five seconds' immersion in a freshly made solution of semesan before planting; and frequent disinfection of all implements, benches, and the like.

SMITH (C. O.). **Crown-gall studies of resistant stocks for Prunus.** —*Journ. Agric. Res.*, xxxi, 10, pp. 957–971, 3 pl., 1925. [Received April, 1926.]

The present paper is a preliminary report of the results of artificial inoculation experiments started in 1913 in California with a view to finding stocks resistant to the crown gall organism, *Pseudomonas* [*Bacterium*] *tumefaciens*, for grafting with the resistant species of *Prunus* [see this *Review*, iii, p. 510]. Forty species of *Prunus* and *Amygdalus*, many of which were represented by several varieties, were inoculated by needle punctures with pure cultures of the organism, the results indicating the existence of great differences in susceptibility among these species and often between the varieties of the same species. This was especially true for *Prunus domestica*, some varieties of which (e.g., Italian prune, German prune, Golden Drop, &c.) exhibited strong resistance, infection resulting in only 15 per cent. or less of the inoculations. The seedlings of these varieties should be tested for inheritance of resistance. *P. armeniaca* S.P.I. 32834 and *P. armeniaca mandshurica* seemed to show a higher resistance than the commercial varieties of apricot or their seedlings that have been tested so far. Preliminary inoculation tests on seedlings of *P. umbellata* indicated a considerable variation in their susceptibility to crown gall, but the results suggest the possibility of finding a highly resistant strain of this species. The highest degree of resistance was found in *P. mume*, which was tested during seven years. Out of 4,950 inoculations only 307, or about 6 per cent., developed infection. Even the more susceptible varieties of this species gave only about

13 per cent. infection. In the two last-mentioned species, as well as in *P. pumila*, *P. besseyi*, and *P. alleghaniensis*, the resistance appears to be a specific character, but further tests are necessary to confirm this. *Amygdalus mira*, the smooth stone peach of China, showed a very satisfactory degree of resistance, while *A. tangutica* and *A. persica potanini* also gave promising results, being much more resistant than standard commercial varieties of peach.

It is pointed out that the inoculation by punctures is a test much more severe than would ordinarily be found under natural conditions, and that probably some of the species tested would have been entirely resistant under nursery conditions.

Species of *Amygdalus* exhibited a high percentage of infection in seedlings raised from stones planted in soil inoculated with fragments of crown gall tissue, but one-year-old seedlings of the species tested, when planted in soil thus inoculated, gave a lower percentage of infection than the trees inoculated through punctures on the twigs.

No practical method for using germicides in treating germinating stones or roots of the peach can as yet be recommended.

McClelland (N.) & Tiller (L. W.). **Causes of flesh collapse.**—*Fruit World of Australasia*, xxvii, 1, p. 34, 1926.

This is a reprint of a preliminary report in connexion with experiments in cold storage of apples at the Cawthron Institute, Nelson, New Zealand.

The authors state that the evidence accumulated up to date indicates that the storage trouble of apples known in New Zealand as flesh collapse [see this *Review*, ii, p. 316; iii, p. 403] is the same as that elsewhere described under the name internal breakdown [see this *Review*, iv, p. 173]. A low temperature (32° to 34° F.) favours the development of this trouble, even when the humidity is low (less than 60 per cent.); while with higher humidities the disease still further increases. Although flesh collapse would probably be entirely prevented at a temperature of about 40°, losses from fungous rots would be increased and the storage life shortened by these as well as by the quickening of the vital processes of the fruit.

The problem of control would appear to be, therefore, the determination of a suitable temperature and humidity to secure the minimum loss from these two causes combined [see also this *Review*, v, p. 308].

Harrison (J. E.). **Cold storage of Pears.**—*Fruit World of Australasia*, xxvii, 1, pp. 30–32, 1926.

After a brief summary of the results of the temperature, maturity, and variety tests carried out in America in connexion with the cold storage of pears [see this *Review*, iv, p. 41], the author refers to tests made in Victoria which confirm in the main the American results. In recent experiments on the influence of maturity and temperature on keeping qualities, two consignments of William pears at different stages of maturity, one fully grown and marketable but still firm and greenish in colour and the other picked before maturity, were stored at 32°, 34°, and 37° F. After eight weeks there was very

little difference between the fruit of the two consignments, but after ten weeks, those of the second picking were superior, having a better taste and showing no signs of wilt, while the fruit of the first picking had all commenced to wilt. The second picking maintained a distinct superiority for some weeks longer. Blackening appeared to take longer to develop on the fruit of the second picking, although eventually both consignments were equally affected.

The fruit stored at 32° gave the best results. Both lots of fruit were kept at this temperature for 13 to 14 weeks with fair success, after which browning developed, particularly in the lot picked early.

DUTTON (W. C.). **Spraying Dewberries for anthracnose.**—*Michigan Agric. Exper. Stat. Special Bull.* 144, 13 pp., 2 figs., 1925.

Anthracnose (*Plectodiscella veneta*) has in recent years caused considerable damage to dewberries [*Rubus* spp.] in Michigan.

An account is given of spraying experiments in 1922 to 1924 for the control of this disease. The results indicate that a delayed dormant application of lime-sulphur (5 galls. in 100, with 1 lb. calcium caseinate) when the buds are one-half to three-quarters of an inch long, and a summer application of Bordeaux mixture (4–8–100) about one week before the flowering period, is effective and amply repays the cost of treatment.

MONIZ DA MAIA (R.). **Contribuição para o estudo da importância fitopatológica do 'Schizophyllum alneum' (L.) Schroet., em Portugal.** [On the phytopathological importance of *Schizophyllum alneum* (L.) Schroet. in Portugal.]—*Revista Agronómica* [Lisbon], 4th Ser., i, 1, pp. 20–22, 1924. [Received April, 1926.]

In the spring of 1921, a disease of olive trees attributed to *Schizophyllum alneum* [*S. commune*] was brought to the notice of the Laboratory of Vegetable Pathology, Lisbon. A characteristic necrosis and peeling off of the bark was found at the base of the affected stems, on which were fructifications of the fungus, the parasitic nature of which is regarded as having been proved. The disease is largely attributed to the unfavourable soil conditions, which were also responsible for the prevalence of *Cycloconium oleaginum*.

In addition to the olive, *S. alneum* is stated to occur in Portugal on *Robinia pseud-acacia*, pine, poplar, willow, apple, and pear.

GADD (C. H.). **Bunchy top disease of Plantains. (A review).**—*Trop. Agriculturist*, lxvi, 1, pp. 3–20, 1926.

This is a full review of the present state of knowledge regarding the bunchy top disease of plantains [*Musa paradisiaca*], containing an account of its geographical distribution (Fiji, Australia, Egypt, and Ceylon) on banana [*M. sapientum*] and plantain, and a discussion of the various theories on its primary causes.

The disease in Egypt has been attributed to nematodes, but the description and published illustrations appear to indicate that it is the same as the Ceylon bunchy top. In Fiji there is evidence that

selection has been effective in developing resistant plants. A separate section deals in detail with the incidence of the disease in the various divisions of Ceylon, and the paper terminates with a reproduction *in extenso* of the recent report of the Investigation Committee of the Bunchy Top Control Board of the Government of the Commonwealth of Australia, already noticed from another source [see this *Review*, v, p. 310].

Panama disease of Bananas in the Canaries and West Africa.—*Trop. Agriculture*, iii, 1, p. 8, 1926.

It is stated that, according to information received from the Imperial Bureau of Mycology, the Panama disease of banana is present in the Canaries on the Cavendish, Chinese, or dwarf banana [*Musa cavendishii*], and in Sierra Leone on the Gros Michel and Guinea Negro varieties. In the West Indies the Cavendish banana is regarded as very highly resistant to or immune from this disease. The *Fusarium* isolated from the vascular system of affected Cavendish bananas in the Canaries behaves in culture like *F. cubense* from the West Indies. The possibility that the organism in the Canaries is a different biological strain of *F. cubense* is referred to.

Since the strain of the fungus in the West Indies rarely, if ever, attacks the Chinese banana grown there, it is advisable to take precautions against the introduction of the strain from the Canaries. It is therefore recommended that no banana suckers should be introduced from the Canaries into any British West Indian territory except for experimental purposes and then only from quarantined areas, and certified as free from Panama disease.

Villedieu (G. & Mme). **La composition et l'action des bouillies cupriques.** [The composition and action of copper mixtures.]—*Comptes Rendus Acad. d'Agric. de France*, xii, 2, pp. 65–70, 1926.

During the period 1924–5 the writers made arrangements for practical testing of their basic copper mixtures [see this *Review*, iv, p. 297] at various experiment stations. Two formulae were used, both of which are stated to give identical results, namely, (1) copper sulphate 10 per cent.; magnesium sulphate 20 per cent.; and ground hydrated calcium sulphate 70 per cent.; (2) copper sulphate 20 per cent.; magnesium sulphate 20 per cent.; and calcium sulphate 60 per cent. The magnesium sulphate possesses no fungicidal properties and acts merely as an adhesive [see this *Review*, iii, p. 464]. The cost of these preparations is estimated at 40 to 63 centimes per kg. The mode of application is similar to that of copper sulphate, 3 kg. of the powders being mixed with 3 kg. of quicklime in 1 hectol. of water.

In 1924 the untreated vines at Beaune were heavily attacked by mildew [*Plasmopara viticola*] in August, a large part of the foliage being destroyed and 95 per cent. of the remainder showing symptoms of infection. The plots treated with Bordeaux mixture or with the basic copper mixtures (last application 21st July) remained free from the disease. No distinction could be drawn between

these two forms of treatment, both of which were reported to be perfectly efficacious.

In 1925, 50 per cent. of the foliage of untreated vines was destroyed at Beaune during an attack which occurred in August. As in the previous year, the plots treated with the basic copper mixtures or Bordeaux mixture (last application on 1st July) remained healthy.

At Épernay in 1925 the untreated vines had lost practically all their foliage by September, while those receiving applications of alkaline Bordeaux mixture or the basic copper mixtures (last treatment 21st July) were in perfect condition, yielding, respectively, 5·2 and 5·5 kg. of grapes per 25 vines, compared with 1.1 kg. in the control.

TISDALE (L. E.). **Colloidal sulphur: preparation and toxicity.**— *Ann. Missouri Bot. Gard.*, xii, 4, pp. 381–417, 1 pl., 4 graphs, 1925. [Received April, 1926.]

Methods have been devised for the preparation of promising colloidal sulphur suspensions for use in practical spraying [see this *Review*, v. p. 237]. In the preparation of colloidal sulphur from sodium thiosulphate (hypo) and sulphuric acid, the most satisfactory method was as follows. Fifty gms. of hypo were dissolved in 40 c.c. of water and warmed to 40° to 50° C.; 40 c.c. of H_2SO_4 (sp. gr. 1·84) were measured into a 500 c.c. glass cylinder. The warm saturated solution of hypo was added slowly to the H_2SO_4, and 80 c.c. of warm water (30° to 40°), followed by the same quantity of 1 per cent. glue solution (which was found to be the most satisfactory protective colloid), were added immediately to the mixture. The stability of the solution was found to be very largely dependent on the temperature. After 48 hours the reaction of the mixture was adjusted to P_H 4·2 with a saturated solution of Na_2CO_3, and then aerated for 30 minutes to eliminate SO_2. The addition of water as indicated is a very important step in the process, changing the physical state of the solution to such a degree that stability is ensured for several days even without the addition of a protective colloid. The neutralization of the mixture may also be effected by a saturated solution of dibasic sodium phosphate. This may be added immediately to the hypo-acid mixture, thereby obviating the 48 hours' delay.

In the preparation of colloidal sulphur from lime-sulphur the most satisfactory mode of procedure was as follows. Fifty c.c. of freshly made lime-sulphur were measured into a glass beaker of 600 c.c. capacity. One gram of dry-flake glue was dissolved in 200 c.c. of water and mixed with the lime-sulphur while warm (35° to 40°). Ten c.c. of HNO_3 were diluted and added to the lime-sulphur until a reaction of P_H 4·2 was obtained, and the mixture was allowed to set for several hours in an open container to remove H_2S. This gave a final dilution, in respect to the original lime-sulphur solution, of 1 to 9. The mixture contained about 1·8 per cent. sulphur. By this method stability for several months is ensured.

The following method was used in the preparation of colloidal sulphur by means of SO_2 and H_2S. Sulphur dioxide (compressed liquid) and hydrogen sulphide (made from FeS and 1 to 1 hydrochloric acid) were passed simultaneously into a 2-litre flask containing 1,500 c.c. of water through two inverted thistle tubes closed with perforated parchment paper, set in a rubber stopper. After three hours a slight excess of H_2S was introduced to free the solution of SO_2. The suspension thus formed contained 12 per cent. sulphur and possessed great stability. In this method the gases are introduced into the liquid in the form of fine jets, thus permitting thorough mixing in the solution. The mixture thus obtained was found to be injurious to the foliage of plants, but this objection was removed by the adjustment of the acid reaction (P_H 1·0) to P_H 4·2 with a weak solution of Na_2HPO_4, after aeration for 48 hours. The resulting solution remained stable for three months. Later the colloidal sulphur was coagulated with NaCl and allowed to settle out of solution in the form of a thin paste, containing about 70 per cent. of water. This began to crystallize and lose toxic properties in about a month, unless it was resuspended in water shortly after preparation, when it kept for eight months.

The colloidal sulphur mixtures prepared by the above methods were found to be toxic to a number of organisms, including most of those used in Young's previous tests [see this *Review*, ii, p. 460], under laboratory conditions. The products spread well, and have good adhesive properties; they caused no injury to foliage under the conditions of the tests.

It appears evident that the toxicity of different forms of colloidal sulphur is due to different toxic substances. The properties of the toxic substance of colloidal sulphur prepared from SO_2 and H_2S, which is slightly volatile, differ from those of the pentathionic acid of Young's hydrophilic colloidal sulphur [loc. cit.], and are most marked at higher temperatures. A gradual increase was observed in its toxicity, beginning at P_H 4·2 and continuing to 5·4, while there is a rapid increase at higher P_H values. Young's hydrophilic colloidal sulphur exhibits the greatest toxicity at P_H 4·2 to 5·4.

Colloidal sulphur preparations are most stable between P_H 3·0 and 5·4. The loss of stability is accompanied by destruction of the toxic property.

In a modified form, the products described in this paper (particularly the preparation made from lime-sulphur) were very effective against apple scab [*Venturia inaequalis*] in Pennsylvania in 1924.

Toro (R. A.). **La influencia del ambiente en la protección de las plantas contra enfermedades.** [The influence of the environment in the protection of plants against diseases.]—*Porto Rico Insul. Exper. Stat. Circ.* 90, 10 pp., 1925. [Received April, 1926.]

The writer briefly discusses, with illustrations from current phytopathological literature, the influence of humidity, temperature, and soil reaction in the protection of plants against disease; and the prevention of infection (*a*) by arresting the dissemination of the pathogen, and (*b*) by producing a modification in the relation between the development of the pathogen and that of the plant.

In Porto Rico the black rot of onions (*Macrosporium parasiticum*) [see this *Review*, iii, p. 498] is stated to be secondary to the ravages of insects, which may be lessened by a free circulation of air round the plants. The incidence of *Rosellinia bunodes* on coffee may be greatly reduced by thinning out the shade trees and thereby exposing the plants to the sun. Similar measures are stated to be effective also against citrus scab (*Sphaceloma fawcettii*) [*Sporotrichum citri*]. The slightness of the damage caused by potato blight (*Phytophthora infestans*) and tobacco mildew (*P. nicotianae*) in Porto Rico is attributed to the relative dryness of the soil. Various other examples are cited of the beneficial effects obtained by a modification of soil humidity.

The virtual absence of onion mildew (*Peronospora schleideni*) and bean anthracnose (*Colletotrichum lindemuthianum*) in Porto Rico is ascribed to the high temperatures, which inhibit their development. During his investigations on banana anthracnose (*Gloeosporium musarum*) [see this *Review*, iv, p. 103] the writer observed that the incidence of infection was much greater at high altitudes than in low-lying situations. *Sclerotium griseum* is stated to attack bananas growing in impermeable soils with great severity.

There are two methods of arresting the dissemination of a pathogen, namely, the interposition of obstacles, such as windbreaks, and the elimination of the means of transmission of the spores, e. g., by increasing the distance between the plants.

In certain cases the development of the pathogen may be influenced by the condition of the host at the time of infection. Thus anthracnose of beans may be largely prevented by sowing during a dry period.

DICKINSON (S.). **A simple method of isolating and handling individual spores and bacteria.**—*Ann. of Botany*, xl, 157, pp. 273–274, 1 fig., 1926.]

A brief description is given of an apparatus for picking up single fungal spores or bacteria, made to the author's design by Messrs. Ogilvy, 20 Mortimer Street, London, W.1.

DUGGAR (B. M.) & ARMSTRONG (JOANNE K.). **The effect of treating the virus of Tobacco mosaic with the juices of various plants.** *Ann. Missouri Bot. Gard.*, xii, 4, pp. 359–366, 1925. [Received April, 1926.]

A series of experiments [the technique of which is described] was carried out to determine the effect on the tobacco mosaic virus [see this *Review*, v, pp. 194, 195] of dilution with the juice of various plants. The mixed juices were kept at room temperature for about two hours and then placed in a refrigerator at 3° C. for 15 to 18 hours.

The tobacco mosaic virus was found to be effectively inactivated by pokeweed (*Phytolacca decandra*) juice at a dilution of one in five. The juice of *Datura stramonium* was effective at a relatively high dilution (1 in 100), while that of geranium (*Pelargonium* sp.) caused a reduction in the number of diseased plants from 20 to 8 and 3, at dilutions of 1 in 10 and 1 in 100, respectively. The juice of the

remaining plants tested (cotton, squash [*Cucurbita*], potato tubers, sweet potatoes, and apples) exercised no effect on the virus.

The possibility that the reaction of the juice might be an important factor in the production of inactivation was excluded, since colorimetric tests showed that the hydrogen-ion concentration was higher in the apple juice, which gave negative results, than in any other tested. Further experiments (to be reported elsewhere) also indicated a relatively high tolerance of the mosaic virus towards acids. *Aspergillus niger* and *Bacterium prodigiosum* made rapid and profuse growth on pokeweed juice, showing that the latter possesses no general germicidal properties. Since all the plants with inactivating juices are hosts of more or less pronounced forms of mosaic, it must be assumed that the inhibitory effect is specific with reference to the tobacco mosaic virus.

Preliminary tests were made to determine the possible relation of the larger colloidal particles in the pokeweed juice to inactivation. The filtrate obtained by passing the juice through a cylindrical porcelain atmometer cup under a pressure of one-half atmosphere was used, as in the above tests, for the dilution of the mosaic virus subsequently employed for inoculation. When the relation of virus to filtrate was 1 in 10, the incidence of infection was nine out of ten plants inoculated; complete inactivation was effected at a concentration of 1 in 100. Filtration through such a filter (which does not admit of the passage of *Bact. prodigiosum*) would seem, therefore, to reduce the effect of the juice.

Some loss of inactivation capacity also followed the dilution of pokeweed juice with an equal quantity of distilled water, with subsequent centrifuging for half an hour at 1,500 revolutions per minute. At a concentration of 1 in 10, two out of ten plants developed the disease.

Negative results were given by inoculation of young tobacco plants with the leaf tissue of the individuals remaining healthy after inoculation with the virus inactivated by pokeweed juice, thus disposing of the possibility that in such individuals the disease is so mild as to produce no external symptoms. A number of the plants that had received the virus inactivated by pokeweed juice were subsequently inoculated with untreated diseased tobacco juice and all developed the typical symptoms of mosaic in less than 15 days.

GRATIA (A.) & RHODES (BERNICE). **The Twort-d'Hérelle phenomenon.**—*Lancet*, ccx, 5343, pp. 204–205, 1926.

Referring to Twort's recent work on the action of the transmissible lytic principle on dead bacteria [see this *Review*, v, p. 239], the writers describe a series of experiments which, they claim, suggest an entirely different interpretation.

A test was made in which a broth suspension of dead staphylococci was pipetted into four sterile test-tubes, of which (1) received two drops of sterile broth; (2) one drop of sterile broth and one of a living staphylococcus culture; (3) one drop of sterile broth and one of filtered lysin; and (4) one drop of filtered lysin and one of a living staphylococcus culture. After three days' incubation at 37° C., (1),

(2), and (3) remained turbid, while (4) showed a striking, though incomplete, clearing.

The filtered lysin alone, therefore, is unable to dissolve dead bacteria, but when associated with living organisms a marked clarification results. Control tests showed that such a result could only be obtained with bacteria of the same species.

The preceding experiment was repeated, using saline instead of broth suspensions. Tubes (1) and (3) remained turbid, while (2) became as clear as (4). In this case it is evidently not the lysin which dissolves the dead bacteria, but the living organisms. The same process no doubt occurs in broth, but in this medium the living bacteria multiply actively and conceal by the opacity of their own growth the clearing of the dead suspension.

In a further test, the bottoms of four sterile test-tubes were filled with broth suspension of dead staphylococci up to a stricture made in the middle, and appropriate amounts of filtered lysin and living bacteria were added as in the first experiment. Immediately afterwards the stricture was closed in a gas flame and the sealed tubes incubated at 37° for three days. Tubes (1) and (3) remained turbid, while (2) and (4) were cleared. As in the saline experiment, the living bacteria in (2) dissolved the dead emulsion as well as in (4), but as they were unable to grow in sealed tubes the clearing remained visible. On opening (2) and pipetting the clarified mixture into an ordinary test-tube, the living bacteria multiply in a few hours and, as in the first test, obscure the clearing of the dead organisms. Thus living bacteria alone dissolve the dead ones.

In further experiments the writers demonstrated the dissolution of dead by living cocci on solid media. The temperature at which the bacteria are destroyed is immaterial. The phenomenon is considered to be of a nutritional character, the living bacteria multiplying while the dead ones are reduced to minute, Gram-negative granules. This not only supplies the true interpretation of the first experiment, but also of Jaumain's phenomenon, i. e., the spontaneous clearing of broth cultures of staphylococci in sealed tubes (*Comptes Rendus Soc. de Biol.*, lxxxvii, p. 790, 1922). In this connexion reference is made to the senior author's studies on the bacteriolytic action of certain moulds [see this *Review*, iv, p. 368].

It is concluded that, so far, no evidence has been adduced to prove that the transmissible bacterial lysin or bacteriophage is capable of dissolving dead bacteria. Such evidence would be of extreme importance in the comprehension of the Twort-d'Hérelle phenomenon.

McLennan (Ethel I.). **The endophytic fungus of Lolium. II. The mycorrhiza on the roots of Lolium temulentum L., with a discussion on the physiological relationships of the organism concerned.**—*Ann. of Botany*, xl, 157, pp. 43–68, 3 pl., 1926.

The presence of an endophytic mycorrhiza of the type characterized by the formation of vesicles and arbuscles [see this *Review*, iv, p. 301] has been established in the roots of *Lolium temulentum*, *L. perenne*, *L. multiflorum*, and *L. subulatum* and a cytological

examination of infected roots has been made in the case of the first-named.

Entry into the root is accomplished either through root hairs or directly through the epidermal cells, and the mycelium tends to form spiral loops in the lumina of the cells of the epidermis and subjacent layer. The hyphae, intracellular in the first root layers, become both inter- and intracellular in the deeper tissues.

Arbuscles and sporangioles are formed in the more internal cortical cells. Vesicles are formed both in the intercellular spaces and, occasionally, in the interior of the cell [see this *Review*, iii, p. 539]. The function of these bodies appears to be primarily an attempt at spore formation, as shown by the increase in the number of nuclei and the dense protoplasmic contents, coupled with abundance of food material at the early stages of development. In most cases, however, the food supply is ultimately assimilated by the host cells, the fat in the young vesicles being removed together with that of the vegetative hyphae. At this stage a large number appear collapsed and empty in the root tissue. In only a few cases [one of which is figured] are bodies resembling spores formed in the vesicles, and it is thought that these may be set free in the soil after the rotting of the root and serve to propagate the fungus.

In the early stages of the association, when the sporangioles are still immature, the hyphae in the outer cells are packed with oil, which stains black with osmic acid after treatment with a bichromate solution. As the sporangioles increase in size they become uneven in outline owing to the pressure of the contained fat. In old roots gathered during late October and November, when the grass is forming grain, the sporangioles have become disrupted and a considerable quantity of fat or oil globules can be found at this stage free in the cell cavity.

Evidence has been obtained, by the cytological examination of the root tissue, in support of the hypothesis that the endophyte is used by the root as a source of carbonaceous nutriment, the fungus apparently deriving little or no benefit from the association. This conclusion is supported by a consideration of the results obtained by Knudson and other investigators [whose work is briefly summarized] in the non-symbiotic germination of orchard seeds. The success achieved in this direction is due to the presence of soluble carbonaceous food in the culture media, which compensates for the absence of the fungus, the function of which, interpreted in the light of the cytology of the *Lolium* mycorrhiza, is thought to be to supply carbonaceous material to the host plant.

McLean (W.). **The control of leaf-roll disease in Potatoes by the diagnosis of 'primarily infected' tubers. Preliminary note.** —*Journ. Agric. Sci.*, xvi, 1, 149–157, 2 figs., 1926.

As reported by Whitehead [see this *Review*, iii, p. 736] the primary symptoms of potato leaf roll are rarely seen in North Wales, and the author has attempted at Bangor to devise a method for the diagnosis of primary infection, so as to distinguish from healthy tubers those of plants infected in the year in which the tubers were formed. The healthy and primarily infected tubers, at the time of lifting, are very similar both in external appearance and chemical composition. On drying at laboratory temperature (about 60° F.), however,

healthy tubers lose weight to a much greater extent than those primarily infected, and the former become soft and flabby while the latter remain hard even after sprouting. It is suggested that healthy seed may be separated from primarily infected seed on this basis.

De Bruyn (Helena L. G.). **Waarnemingen over de vatbaarheid van het loof van de Aardappelplant voor de Aardappelziekte.** [Observations on the susceptibility of the foliage of the Potato plant to blight.]—*Tijdschr. over Plantenziekten,* xxxii, 1, pp. 1–29, 2 pl., 1926. [English summary.]

Experiments were carried out at Wageningen in 1923 and 1924 to attempt to determine the factors other than varietal characters governing the susceptibility to blight (*Phytophthora infestans*) of potato foliage [see also this *Review,* iv, p. 761; v, p. 180].

Six different varieties were planted in alternate rows on six separate dates. The plants were examined weekly and counts made of the incidence of blight. Little difference was shown between the plants planted in March to May, whereas in those planted from May to July the divergence was striking, the incidence of infection being much heavier in the late than in the earlier plantings. This was particularly marked in the case of the susceptible Schotsche Muis (Early Midlothian), Lena, and Ehnola varieties.

In 1924 five different varieties, each comprising 24 plants, were dug each fortnight from 15th June to 15th September. The varieties with rapid tuber formation, e.g., Early Midlothian and Bintje, showed a correspondingly rapid spread of infection, while on those with slow tuber formation, e.g., Koh-i-Noor, the attack advances more slowly.

The writer agrees with Pethybridge [*Rept. Intern. Potato Conf.,* p. 112, 1921] and others that resistance to blight may be due to the presence of some substance in the cells which inhibits the development of the mycelium within the tissues. The acceptance of this theory involves the supposition that meteorological conditions, fertilizers, type of soil, and other external factors will also affect the resistance of the host. A double series of experiments was therefore conducted to ascertain whether susceptibility could be modified by alterations in the external conditions. Six greenhouse plants were watered daily, six were treated normally, and six others were kept as dry as possible. At maturity the stems were wounded and inoculated with a pure culture of *P. infestans.* The plants grown in the very dry soil were the most resistant (22 and 15 per cent. infection) in the two series, while those cultivated normally and in very wet soil showed 41 and 38, and 50 and 23 per cent., respectively. Should these differences be maintained in the field, the weather prevailing before the outbreak of the disease might influence the susceptibility of the crop.

It is apparent from these data that individuals of the same variety do not always possess an identical degree of susceptibility, since this depends to some extent on the state of development of the plant and on external conditions during its growth.

A table is given showing the correlation between the date of maturity, first appearance of the disease, and progress of the latter, in the chief Dutch and foreign varieties.

Martin (W. H.). **Potato spraying and dusting in 1923.**—*Forty-fifth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1924,* pp. 381–389, 1925. [Received March, 1926.]

Despite the exceptionally dry weather of 1923 and general unfavourable conditions for potato growing, increased yields were obtained in all the spray tests, both with the commercial and late crop [see also this *Review*, iv, p. 694].

In one test with commercial Irish Cobblers, a commercial Bordeaux mixture (Pyrox) gave slightly larger returns than home-made Bordeaux 5–5–50.

The use of kayso did not increase the fungicidal or adhesive qualities of Bordeaux mixture, little of which was washed away, owing to the dry weather.

Copper-lime dust was less effective than Bordeaux mixture in the control of tipburn, hopperburn, and early blight [*Alternaria solani*].

In a commercial test with American Giants, eight applications of Bordeaux mixture gave an average yield increase of 24·3 bushels per acre, compared with 18·4 bushels where the first four applications were omitted.

In a similar test with the Norcross variety, the average yield increase of the plots treated with Bordeaux mixture was 13·2 bushels per acre. Copper-lime dust again proved ineffectual.

In a test with late crop Irish Cobblers, two applications of a 10–10–50 Bordeaux mixture gave a yield increase equal to that resulting from four applications of 5–5–50. Hydrated lime was equally efficacious with stone lime in the preparation of the mixture.

Gaines (J. G.). **Potato scab control studies in 1923.**—*Forty-fifth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1924,* pp. 414–421, 1925. [Received March, 1926.]

Practically the same degree of control of scab (*Actinomyces scabies*) on Irish Cobbler potatoes was given by the application of inoculated sulphur at the rate of 500 lb. per acre [see this *Review*, iv, p. 698] or of equal quantities of inoculated sulphur and rock sulphate, 1,200 lb. per acre of which gave 4 per cent. more clean tubers than 800 lb. and 12·2 per cent. more than 400 lb. The P_H value of the soil solution was lowered 0·83 by 500 lb. sulphur and 0·78 by 1,200 lb. rock phosphate and sulphur. In one test the use of a fine mesh (200) for screening the sulphur resulted in a reduction of 49·4 per cent. in unsaleable tubers compared with 38·3 and 22·1 per cent. for the medium and coarse meshes (80 and 20), respectively. With the resistant Giant variety better results were given by inoculated sulphur and rock phosphate than by the former alone.

MacMillan (H. G.) & Meckstroth (G. A.). **The critical temperature for infection of the Potato seed piece by Fusarium oxysporum.**—*Journ. Agric. Res.*, xxxi, 10, pp. 917–921, 1925. [Received April, 1926.]

The results of the authors' experiments [technical details of which are given], in which pieces of sterilized tubers of the

moderately resistant Early Ohio variety of potatoes were inoculated with a pure culture of *Fusarium oxysporum*, and kept for 300 hours under approximately normal conditions and at constant temperatures ranging from 13° to 15·5° C. (at intervals of 0·5° each) in an adaptation of the Wisconsin tank [see this *Review*, iv, p. 50], showed that under 14° no infection occurred, and the fungus could not be recovered from the inoculated pieces at the end of the experiment. At 14°, visible symptoms of infection did not occur, but 25 per cent. of the pieces yielded the fungus in pure culture. At the higher temperatures, the seed pieces presented obvious symptoms of infection, and the fungus was recovered in all cases.

POOLE (R. F.). **Sweet Potato disease studies.**—*Forty-fifth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1924*, pp. 392–399, 1 pl., 1925. [Received March, 1926.]

The best results in the control of pox or ground rot of sweet potatoes (*Cystospora batata*) [or *Actinomyces*: see this *Review*, iv, p. 466] in 1923 were obtained by the application of 300 lb. inoculated sulphur per acre, which reduced the incidence of infection from 62·7 to 32·7 per cent. and increased the yield from 66·4 to 123·2 bushels per acre [see also this *Review*, iv, p. 765]. The incidence of infection was still further reduced by larger applications (500, 600, and 800 lb.), but the resulting injury caused a lower yield. The application of lime (1,000, 1,500, and 2,000 lb. per acre) greatly increased infection and caused heavy reductions in the yield. In another test the 400 lb. application of sulphur was nearly as effective as those of 500 and 600 lb. in controlling the disease and much more so than the 300 lb. application. It was further shown that sulphur can be mixed with fertilizers and applied at the same time.

Laboratory studies on the scurf or soil stain disease of sweet potatoes (*Monilochaetes infuscans*) indicated that much infection occurs at the moderately high ranges of soil moisture (14 to 23 per cent.), the disease being less severe at saturation point (26 per cent.) and at the lower ranges (3 and 6 per cent.). The results of tests on the effect of the culture reaction on the growth of the fungus, using a modified Cook's synthetic medium and sweet potato extract, indicated that the maximum development occurs near the neutral point and in slightly alkaline cultures. Growth was inhibited at P_H 3·2 and very slight at 4·0. Good control of the disease in the field was given by the application of sulphur at the rate of 300, 400, or 500 lb. per acre. In one test the two latter treatments reduced the incidence of infection from 89·2 to 5·8 and 9·6 per cent., respectively. The application of lime promoted the development of the disease.

THOMPSON (A.). **A disease of the Betel vine caused by a species of Phytophthora.**—*Malayan Agric. Journ.*, xiv, 1, pp. 1–6, 1926.

A new disease of the betel vine [*Piper betle*] was reported in 1923 from the east coastal area of Malaya. In 1924 an organism was isolated by the author from diseased material and determined as a species of *Phytophthora*, the morphology and cultural characters

of which are described in detail. The disease is stated to resemble a typical wilt. The stem, which is rotted at the base, turns brown and withers, and the leaves droop. In the majority of cases the attack appears to begin an inch or so below ground level. At this point the stem tissues are black to reddish-brown externally and soft and gummy, with brownish-red streaks, inside.

In culture the aerial hyphae are sparingly branched and regular, while those submerged in the medium are more branched and irregular in outline. The diameter varies from 3 to 7 μ. Sporangia are produced in large numbers and may be lateral, terminal, or intercalar. The last differ from the chlamydospores in their irregular shape and the frequent existence of a papilla. The shape is very variable, ovate with a prominent papilla, curved, or tapering at the ends. On maize agar the mean dimensions were $41{\cdot}99 \pm 0{\cdot}479$ by $27{\cdot}25 \pm 0{\cdot}228\,\mu$. The size differed little on green pea agar, but those grown on fresh rubber pods and areca nuts were slightly smaller.

The zoospores may either emerge in a mass and then separate, or may be liberated individually. They number 16 to 20 in a sporangium, and are 12 to 16 μ in diameter. Sporangia larger than 30 μ long generally germinate directly by means of germ-tubes, on which secondary sporangia are borne.

The chlamydospores vary in diameter from 18 to 33 μ (average 24·45 μ). No sexual spores have yet been found.

Inoculations gave, under conditions of high humidity only, successful infection on betel vine (wounded and unwounded) at soil level, rubber pods, and green nuts of the areca palm [*Areca catechu*]. A diseased patch similar to patch canker [see this *Review*, iv, p. 702] was produced in 14 days on two out of six *Hevea* rubber trees inoculated on the scraped virgin bark of the trunk. Inoculations on the tapping cut of *Hevea* and on fruits of papaw and eggplant failed. It is concluded that the fungus is not a vigorous parasite, except when climatic and soil conditions are favourable to its spread.

In the absence of sexual fructifications the species has not been identified. It is stated to be clearly distinct from *P. faberi*, *P. palmivora*, and the forms responsible for causing black stripe and patch canker of *Hevea* in Malaya [see also this *Review*, iv, p. 702], all of which have been compared with the betel vine pathogen under identical conditions of culture. The recent Indian record of a similar fungus on the same host [see this *Review*, iv, p. 718] is referred to.

Gesetze und Verordnungen. Dänemark. [Laws and regulations. Denmark.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, vi, 2, p. 16, 1926.

By a regulation of the Danish Ministry of Agriculture, dated 5th December, 1925 (effective as from 1st January, 1926), all consignments of plants imported into Denmark with adherent soil, e. g., fruit and other trees, shrubs, herbaceous plants, root vegetables, bulbs, ornamental plants, and the like, must be accompanied by a duly authenticated certificate to the effect that the locality of growth, together with a surrounding radius of at least 10 km., is free from wart disease of potatoes [*Synchytrium endobioticum*].

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

VOL. V JULY 1926

STEVENS (H. P.). **Paranitrophenol as a mould preventive.**—*Bull. Rubber Growers' Assoc.*, viii, 1, p. 40, 1926.

Further tests carried out by Mr. J. Edwardes in Malaya indicate that the period of soaking sheet rubber in paranitrophenol recommended as a preventive of mould [see this *Review*, v, p. 126] can be reduced from three hours to half an hour without diminishing its efficiency.

DEENEN (W. J.). **De bodemreactie in verband met enkele plantenziekten.** [The soil reaction in connexion with certain plant diseases.]—*Arch. voor Suikerind. Nederl.-Indië*, xxxiv, 4, pp. 105–119, 1926.

The principal European researches of the last twenty years on the correlation between soil reaction and plant diseases are reviewed and discussed. The root rot of sugar-cane in Java [see this *Review*, v, p. 187] is regarded as a counterpart to the veenkoloniale [grey speck] disease of oats [see this *Review*, iv, p. 275], and defective soil conditions are believed to be responsible for at least one type of the former disturbance. The necessity for further experiments in the modification of the soil reaction, not only with manganese sulphate, but also with such known acidifying substances as sulphur, peat, and mud, is strongly emphasized.

COTTRELL-DORMER (W.). **Cane pests and diseases.**—*Queensland Agric. Journ.*, xxv, 1, pp. 45–47, 1926.

An acute disease, for which the name 'brown rot' is proposed, was first observed at St. Helen's in the Tully district of Queensland, and has since been found in four other localities. Severely affected stools closely resemble those infested by grubs, the leaves being wilted or desiccated though fairly normal in size. The outer leaf sheaths of young canes are quite disintegrated at the junction with the stem, and are cemented together at their bases by a thick stroma of a strong, felt-like consistency, ranging in colour from

dark brown on the outer sheaths to white nearer the interior. Buds, root eyes, and adventitious roots in or below this region are soft and dry, and the stem tissues are dry and pithy. The whole of the parenchymatous tissue at the internodes is of a pale russet-brown colour, the vascular bundles being of a similar but darker tone, and the diseased area is divided from the healthy portion by a narrow, nearly black zone about half an inch deep. The disease appears to occur in patches, and has so far proved uniformly fatal. It has been found exclusively on new scrub soil in which the Badila variety is chiefly planted.

Gumming disease [*Bacterium vascularum*] is stated to be decreasing in severity in the Herbert River region, mainly owing to the substitution of Q. 813 for the highly susceptible Clark's Seedling and to increased attention to drainage on the part of the farmers.

Top rot [see this *Review*, ii, p. 581] caused heavy damage in two fields of plant cane at Macknade. The Green Goru and Clark's Seedling varieties were severely attacked by red rot [*Colletotrichum falcatum*: see this *Review*, iv, p. 568] in two localities, and foot rot [see this *Review*, v, p. 327] is causing slight damage on many farms.

North (D. S.). **Gumming disease on the Clarence.**—*Australian Sugar Journ.*, xvii, 10, pp. 661–662, 1926.

This is a précis of a lecture delivered before a meeting of Clarence River [New South Wales] farmers, the full report of which appeared in the *Clarence River Advocate* of 17th October, 1925, and was reprinted in a pamphlet issued by the Colonial Sugar Refining Company.

Gumming disease [*Bacterium vascularum*] is no longer confined to the known infected areas of this district on Lower Palmer Island, but has been carried across the river, where three out of six farms were found to be diseased. Rats appear to be very active agents in the transmission of infection, which is also carried by insects, agricultural implements, and the like, though the most prolific source of spread is the use of diseased seed cane. Apart from ploughing out all the cane on the diseased farms and not replanting for a year, the most effective control measures are probably the use of healthy seed and the choice of resistant varieties, e.g., Malabar, H.Q. 5, New Guinea 16 and 14 (the latter, however, being subject to Fiji disease [*Northiella sacchari*]), and Q. 813. Susceptible varieties which have had to be abandoned at Broadwater include 1900 Seedling, Innes, Mahona, Badila, and D. 1135.

The Colonial Sugar Refining Company is conducting a series of variety tests on the Richmond and Herbert Rivers and in Sydney, New South Wales, with the special object of raising a sufficient number of gum-resistant canes (H.Q. 5, N.G. 14 and 16, with China and Uba, as parents). Arrangements are to be made for extending this work to the Clarence and Tweed Rivers. Experience has shown that at least ten years is requisite for the proper testing and valuation of cane.

The Clarence Sugar Executive is making an appeal to growers in the affected areas to destroy infected fields, to discontinue the planting of susceptible varieties, and to experiment in the cultivation of resistant types.

LEE (H. A.). **Pathology.**—*Rept. Committee in charge of Exper. Stat. for the year ending September 30, 1925.—Proc. Forty-fifth Ann. Meeting, Hawaiian Sugar Planters' Assoc., 1925*, pp. 39–48, 2 pl., 1926.

A method for determining eye spot [*Helminthosporium sacchari*: see this *Review*, iv, p. 567] resistance or susceptibility in new seedling cane varieties has been developed. Cane stalks of ten points length are placed under conditions of high humidity, so that growth is maintained, and an infusion of spores is sprayed over the cane. The eye spot lesions are counted and measured after ten days have elapsed. Using this method, it has been found that certain varieties such as P.O.J. 979, 234, 213, and 36 are commercially resistant to eye spot; Uba No. 1 is more susceptible, but could be grown without serious loss in all districts unless conditions are especially favourable to the disease. Observations as to the influence of locality on susceptibility indicate that in the northern part of the islands, where the daylight is of shorter duration and where air movement is reduced, leaf infection becomes so severe as to result in rotting of the top of the stem, whereas in the gullies only minor injury is caused. It appears that, other conditions being equal, foliage on old cane is as susceptible as that of young cane. The development of mechanical methods for the application of fungicidal dusts for the control of this disease is under investigation.

Mosaic is not at the present time causing any tangible loss in Hawaii. On the irrigated plantations of Maui and Oahu there is still a good deal, but the almost complete replacement of Lahaina by H. 109 has done much to lessen the disease.

Pot experiments have shown that the Hamakua type of Lahaina disease, or growth-failure of D. 1135, is non-infectious. Analytical and solution-culture evidence indicates that an excess of soluble aluminium salts is the cause of this failure, and applications of bagasse-ash or potash should alleviate the injury caused.

Sugar-cane chlorosis on limestone soils has been satisfactorily remedied by iron sulphate dust applications. Similar results were obtained with the distinctive type of chlorosis found on the red upland soils and with a third type found in young ratoons, especially in H. 109.

COOK (M. T.). **Histology and cytology of Sugar-cane mosaic.**—*Journ. Dept. Agric. Porto Rico*, ix, 1, pp. 5–27, 7 pl., 1925.

In this paper previous histological and cytological studies on mosaic diseases [see this *Review*, iii, pp. 452, 598; iv, p. 362] are discussed, and an account is given of the author's observations on both leaves and stems of mosaic sugar-cane.

The light-coloured areas of diseased leaves are always slightly thinner than the dark green areas on the same leaf, and the cells slightly smaller in size. The intracellular bodies described by Kunkel [loc. cit.] were detected, but were scarce and inconspicuous. They were only found in the white areas of the leaves and near the growing points in the stems, more especially in young, rapidly growing plants. Although irregular in shape, the bodies, which

appear to be protoplasmic, are seldom amoeboid. They may be either dense or very delicate and staining very slightly; in some cases they appear to be surrounded by a fine membrane. They are closely associated with the cell nucleus, which is often much enlarged. In the pale areas of the leaf very large and irregular nuclei occur, even when there appears to be no trace of the intracellular bodies. With age and exposure to light, as in the white areas of the older leaves, the nuclei tend to resume their normal form. Many of the abnormal nuclei are very elongated, and resemble flagellates, but there is no difficulty in determining their true character. The variation in character of the chloroplasts is equally marked: those present in the white or yellow areas are smaller and fewer in number than in the green areas; and in the sheath cells in affected areas they are usually grouped near the wall in one part of the cell. Their small size is considered to be due to imperfect development rather than to degeneration. In this case also they increase in size with age and exposure to light. The internal cavities in both stems and leaves seem to be always associated with the fibro-vascular bundles, and start by a gradual disorganization of the walls of the xylem and adjoining parenchyma, not preceded by thickening. In most cases these cells are filled with a dense protoplasm, and they often contain a number of small bodies, staining exactly like nucleoli. As the protoplasm disintegrates these become very prominent. Similar bodies, however, were seen in normal tissues.

BROWN (W.) & HORNE (A. S.). **Studies in the genus Fusarium. III. An analysis of factors which determine certain microscopic features of Fusarium strains.**—*Ann. of Botany*, xl, 157, pp. 203–221, 1 pl., 2 figs., 1 graph, 1926.

In continuation of the first-named author's previous investigations [see this *Review*, iv, p. 627], a study has been made under different cultural conditions of certain microscopic features of *Fusarium* [*blackmani*] strains, with special reference to the degree of septation of the spores.

A striking correlation was observed between the intensity of staling shown by the fungus colony and the degree of spore septation, the staled type of growth being associated with spores of low septation and the unstaled with highly septate spores. Low septation was found to be produced by high concentration of the nitrogenous constituent of the nutrient medium; low concentration of the phosphate constituent; the presence of growth-retarding substances, e. g., an excess of acid or alkali or of a toxin such as phenol, in the nutrient; and increase of temperature [see also this *Review*, iv, p. 367].

The ratio of the concentration of the carbon to the nitrogen constituents was found to be a primary factor in the determination of the nature of the spore contents, as well as the degree of septation. This factor also determined other characteristics, such as the presence or absence of constrictions at the spore septa, the tendency to atrophy and death, the inclination to germinate *in situ*, and the presence or absence of abnormally swollen segments.

Brown (W.). **Studies in the genus Fusarium. IV. On the occurrence of saltations.**—*Ann. of Botany*, xl, 157, pp. 223–243, 1 pl., 2 graphs, 1926.

In continuation of his previous experiments [see preceding abstract], the writer carried out a series of tests to ascertain whether any changes in rate of growth or other characters were taking place in the course of the routine culture of certain strains of *Fusarium* [*blackmani*].

There was no evidence of slow cumulative change during the period occupied by the experiments (about 1½ years).

In the case of some strains inocula of spores give rise to colonies identical with those arising from mycelial inocula, while in other cases slight but definite differences arise.

Saltations occurred from time to time in the course of culture, especially in Richards's solution. The nature of this phenomenon is discussed at considerable length and in the light of the observations of other workers. In the strains of *F. blackmani* the tendency to saltate is a function of the culture medium. So far no evidence is available as to the genetic nature of the saltation effect. The term mutation, as applied to the fungi and bacteria, can only mean the occurrence of sudden changes, and has no implications of a genetic character, since nothing is known of chromatic changes in the nuclei. The new strains developed in isolated patches over the surface of the parent colony. The percentage of saltated areas increases with the age of the colony, and is greater in the centre than at the periphery. In some cases very pronounced change in parasitic power has been observed in some of the saltants as compared with their parents.

The bearing of these results on the preservation of the vigour of strains in culture is discussed, and suggestions are made as to the types of medium to be used (*a*) for the retention of the original form, and (*b*) for the encouragement of saltations.

Ashby (S. F.) & Nowell (W.). **The fungi of stigmatomycosis.**—*Ann. of Botany*, xl, 157, pp. 69–83, 2 pl., 1926.

In this paper a description is given of the morphological characters of four species of fungi which are of common occurrence in the West Indies in connexion with a diseased condition of fruits, which the authors term stigmatomycosis, in which externally healthy fruits are found to be internally infected as a result of punctures made by plant-feeding bugs of the sub-order *Heteroptera*.

The species of *Nematospora* and allied forms, originally described by Nowell as A, B, C, and D [see this *Review*, v, p. 202], are now named as follows: A. *Spermophthora gossypii* n. g., n. sp., parasitic on the lint and in the seeds of cotton; in tomato fruit; and in the seeds of cowpea (*Vigna catjang*) in various parts of the West Indies. B. *Eremothecium cymbalariae* Borzi (*Bull. Soc. Bot. Ital.*, xx, 1888), occurring in cotton bolls and fairly common in tomato fruits in some localities. C. *Nematospora gossypii* n. sp., parasitic on the lint and in the seeds of cotton in the Lesser Antilles and Tropical Africa; and in the seeds of *Datura metel* and *Asclepias curassavica* in the West Indies. D. *N. coryli* Peglion (*Centralbl. für Bakt.*, vii, p. 754, 1901), which is stated to be by far the most

widely distributed agent of stigmatomycosis in the West Indies, having been found on fruits of 16 genera. Lee's *Nematospora* on citrus fruits in China, Japan, and the Philippines [see this *Review*, iv, p. 90]; Schneider's form occurring on tomatoes in California, Cuba, and Mexico (*Phytopath.*, vi, p. 395, 1916; vii, p. 52, 1917); and Wingard's *N. phaseoli* in Virginia [see this *Review*, v, p. 202] are all regarded as strains of *N. coryli*.

The occurrence of *N. coryli* on cotton is usually associated with infestation by the green bug, *Nezara viridula*, which is sometimes very abundant in St. Vincent on *Cajanus*, *Dolichos*, *Phaseolus*, *Vigna*, and other cultivated Leguminosae.

Previous discussions of the genus *Nematospora* have been based on *N. coryli* or on the above-mentioned more recently described species which the writers regard as probably identical with it. The thallus of *N. coryli* is typically toruloid or yeast-like, its mycelial forms being developed only under adverse conditions or after long artificial culture. In *N. gossypii* the position as regards the thallus is reversed, the characteristic form being definitely hyphal, and the toruloid form being assumed only under unfavourable conditions in which there is no spore production. This species, however, cannot be excluded from the genus *Nematospora*, owing to the close correspondence of its sporangia and its very special type of spores, which are arranged in bundles (usually two to six), with intertwined appendages, precisely as in *N. coryli*. In slightly acid peptonized cane juice the spores measured 32 to 37 by 2·5 μ, with appendages twice as long, while on potato the dimensions were 24 to 32 by 2 to 2·5 μ with appendages 100 μ or more in length. In germination a globular expansion arises just anterior to the middle of the spore and gives rise to one or more germ-tubes. The first septum in the latter develops 150 to 200 μ behind the growing tips, and others at intervals of 50 to 70 μ, as a first stage in sporangium formation. The septa may measure up to 6 μ in thickness. At an early stage of growth lateral buds are developed on the hyphae, singly or in short chains; they fall away and each may germinate by a tube growing out into the normal bifurcated mycelium.

In the authors' opinion the classification of *N. coryli* as a Saccharomycete and the designation of its sporangia as asci must be accepted with reserve in the light of the present investigations on *N. gossypii*. Should the suspected relationship between the three genera under discussion, evidenced by the formation of spores in a sporangium originating in the expansion of a hyphal cell, their liberation by solution of the wall, their continuous hyphae (except in connexion with sporangium formation), and their mode of life, be confirmed, a new group may be required for their reception.

So far as their characters are known, the principal difference between *N. gossypii* and *E. cymbalariae* lies in the absence from the latter of the spore appendages. *S. gossypii* differs more widely, as regards its primary sporangia, by the indeterminate number and arrangement of the needle-shaped, hyaline, continuous spores, which measure 18 to 21 by 2 to 2·5 μ. Small secondary sporangia are formed in this species, and result from a secondary mycelium arising from the fusion of two or more primary spores. These are

up to 10 by 4μ and contain a few spores, 4·5 to 6 by $1{\cdot}3\mu$ in diameter. They have the necessary characters for classification as asci, with the consequent inclusion of the species in the Protascineae. This excludes the primary sporangia of *Spermophthora*, and possibly the fructifications of *Eremothecium* and *Nematospora*, from the category of asci.

English diagnoses of the new species are given.

DOYER (CATHARINA M.). **Untersuchungen über die sogenannten Pestalozzia-Krankheiten und die Gattung Pestalozzia de Not.** [Investigations on the so-called *Pestalozzia* diseases and on the genus *Pestalozzia* de Not.]—*Meded. Phytopath. Lab. 'Willie Commelin Scholten'*, Baarn, Holland, ix, 72 pp., 2 pl., 14 figs., 11 graphs, 1925.

This study is based on cultures at the Centraalbureau, Baarn, the author's own isolations, and the examination of a number of exsiccata. The subgenus *Pestalozzina* is excluded, as being distinct from *Pestalozzia* in its hyaline spores. The spores in *Pestalozzia* may be borne in pycnidia or acervuli, the former occurring especially in liquid cultures of *P. hartigii.*

Klebahn's scheme of classification (*Mycol. Centralbl.*, iv, 1, pp. 1–19, 1914) is followed. In the *funerea* group (with three dark olive-green central cells and granular walls) a number of strains were isolated from conifers and rhododendrons. Their characters are described in detail, and they fall into three species—a small spored with generally three long cilia, which is identified with *P. macrotricha*, a typically 4-ciliate form regarded as *P. funerea*, and a form with one, or sometimes two, cilia named *P. monochaetioides* n. sp.

The *guepini* group has also three dark cells, but these are bright olive-green and without granular walls. Two species are distinguished, namely, *P. guepini* (in which are included the var. *vaccinii* Shear on cranberry, as well as *P. palmarum*) and *P. theae*; the cultures of the latter examined originated from coco-nut and *Altingia* in the Dutch E. Indies.

The *versicolor* group is characterized by the presence of a dark band between the second and third dark cells from the stalk, and includes *P. versicolor* and *P. virgatula.* The first of these is held to include *P. scirrhofaciens* Brown and probably *P. phoenicis.*

In the *hartigii* group there are only two dark cells. This group was not met with except as one culture of *P. hartigii.*

The fungus described by Sorauer as *P. lupini* was found by the author on *Lupinus polyphyllus*, and is stated to be not a *Pestalozzia* but *Ceratophorum setosum* Kirchner, of which *Mastigosporium lupini* [see this *Review*, iii, p. 582] is stated to be a synonym; it was successful in producing infection on lupin and *Cytisus* leaves.

A detailed discussion is given of the parasitism of these forms. *P. funerea*, *P. hartigii*, and several other forms tested were found to be unable to infect conifer seedlings, nor could adults be successfully inoculated even when Miss Brown's isolation of *P. scirrhofaciens*, reported by her to be pathogenic, was used. No evidence was obtained that any *Pestalozzia* had more effect than a *Mucor* or a *Penicillium.* Attempts were made to produce leaf spots on rhododendrons, *Camellia*, tea, and palms with strains of *P. funerea*,

P. guepini, *P. theae*, and *P. macrotricha*, but these also failed altogether, unless the leaves were wounded, and then gave only negligible results with no sign of spreading infection. Similar results were given on rhododendron leaves with *Penicillium italicum*.

It is concluded that the diseases attributed to the forms of *Pestalozzia* studied are really due to other causes.

OVERHOLTS (L. O.). **Mycological notes for 1924.**—*Mycologia*, xviii, 1, pp. 31–38, 1 pl., 2 figs., 1926.

In these notes, the following items are of phytopathological interest.

Cucumber fruits (*Cucumis sativus*) of the 1924 crop in Pennsylvania, exhibiting a gummy, amber-coloured exudation, were found to be attacked by *Cladosporium cucumerinum* Ellis & Arth., which was apparently causing considerable damage locally.

Sections through fruiting bodies of *Coccomyces lutescens* Higgins, collected at Walden, Vermont, on *Prunus serotina*, showed the usual macroconidia, the microconidia described by Higgins, and the early stages in the development of the ascigerous stage. The macroconidial stage exhibited the typical characters of *Cylindrosporium padi*. The microconidial stage, with bacilliform spores about 4 by 1 μ in size, was developed as an acervulus external to the stromatic mass which is thought to be the forerunner of the perithecial fructification. In the author's preparations there was no indication that the microconidia were produced from the same conidiophores as the macroconidia, as stated by Higgins.

A new record for America, so far as the author is aware, is that of *Gnomonia rubi* Rehm, which killed a large number of canes in a thicket of *Rubus allegheniensis* in Vermont, in August, 1924. The spores, 4 in each ascus and 12 to 15 by 2·5 to 3 μ in diameter, frequently appeared to be 4-celled.

KERN (F. D.) & WHETZEL (H. H.). **Some new and interesting Porto Rican rusts.**—*Mycologia*, xviii, 1, pp. 39–47, 1926.

The rust fungi listed in this paper, four of which are new species, were collected by the authors on the occasion of a visit to Porto Rico during the months of June and July, 1924. Of interest is the discovery in Porto Rico of *Puccinia sorghi* Schw. [*P. maydis* Béreng.] and *P. pallescens*, both on *Zea mays*. The latter species was collected at the Trujilla Alta Demonstration Farm. *Cerotelium* [*Kuehneola*] *desmium* is common on cotton throughout the island and was also found attacking *Montezuma speciosissima*, which is grown as a roadside shade tree, at Rio Prieto.

MCCORMICK (FLORENCE A.). **Perithecia of Thielavia basicola Zopf in culture and the stimulation of their production by extracts from other fungi.**—*Forty-eighth Ann. Rept. Connecticut Agric. Exper. Stat.* (*Bull.* 269), pp. 539–554, 3 pl., 1925. [Received April, 1926.]

The perithecial stage of *Thielavia basicola* was found by the writer in the roots of tobacco, pea, violet, and antirrhinum. The perithecia occur chiefly in the cortex, but also on the surface among

masses of chlamydospores, and none of the root tissues is entirely free from invasion. Cultures from the violet roots were obtained on oat agar with tobacco extract, and were subsequently transferred to carrot agar, on which perithecia formed. In culture the perithecia are nearly globular, but in nature the pressure of the surrounding cells of the host may make them elongated. The enveloping sheath of tightly intertwined hyphae is hyaline or slightly tinted. There is no trace of any kind of aperture, so that the perithecium may be considered a true cleistocarp. The maximum dimensions of the perithecia on tobacco and pea were 72 and 66 μ, respectively, while those on violets sometimes measured up to 99 μ.

The hyaline, nearly oval asci contain eight dark brown, lenticular ascospores, measuring 10 to 13 by 4·5 to 6·5 μ, and containing relatively large oil drops. The ascogonium begins as a small lateral branch, attached at right angles to the main hypha: in its early stages it resembles *Aspergillus herbariorum* and *A. repens*, except in the absence of loose coils.

The germination of 42 ascospores was obtained in hanging drops containing a trace of pepsin. Germination occurred in about five days and was most abundant with spores taken from six- to eight-week-old cultures. The germ-tube has a unilateral, bulbous enlargement next to the spore coat. The mycelium is white, delicate, and inconspicuous, with sparsely growing hyphae. No chlamydospores or endoconidia were produced by these cultures in a period of over two years. The fungus usually considered to be the conidial stage of *Thielavia* is referred to the genus *Thielaviopsis* as *Thielaviopsis basicola* and the author's experiments are considered to indicate that the two forms are not genetically connected, although frequently associated.

The production of perithecia was greatly stimulated by the culture being grown in association with *Thielaviopsis basicola* from tobacco, violet, and pea, or with *Cladosporium fulvum*, and various other fungi. In all cases the perithecia thus obtained were identical with those from the original violet culture. Similar results were secured with water extracts of *Thielaviopsis basicola* and other fungi, and with a water solution of taka-diastase.

This is stated to be the first report of the isolation of *Thielavia basicola* in artificial culture.

Poole (R. F.). **Tomato disease studies.**—*Forty-fifth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1924*, pp. 400–403, 1925. [Received March, 1926.]

The treatment of early Bonny Best tomatoes by spraying and dusting was found to be of no value in the absence of heavy infection by leaf spot (*Septoria*) [*lycopersici*: see also this *Review*, iv, p. 709]. On the Greater Baltimore variety the best results were given by treatment with Bordeaux mixture, the copper-lime dust (20–80) being less effective.

Bacillus carotovorus caused serious losses on tomatoes injured by severe hail storms. Rapid decay was also produced in the fruit by *Oidium oospora lactis* [? *Oospora lactis parasitica*: see this *Review*,

iii, p. 238] and *Rhizopus* sp., while species of *Fusarium* and also *Macrosporium* [*Alternaria*] *solani* caused a slow, dry rot.

CLINTON (G. P.). **Fungous and non-infectious troubles of ornamental trees.**—*Forty-eighth Ann. Rept. Connecticut Agric. Exper. Stat. for the year 1924* (*Bull.* 263), pp. 171–192, 8 pl., 1925. [Received April, 1926.]

The following physiological diseases of ornamental trees are briefly described: knots on oak and hickory [*Hicoria* spp.] due to some form of irritation in the cambium layer; bunched sprouts on elm and maple, associated with the formation of adventitious buds as a result of some obscure injury; damage caused by drought and heat, smoke and gas (the former arising largely from brick-kilns), spraying, and electricity; and mechanical injuries which sometimes result in 'bleeding', sour sap, and a slimy flux, the two latter manifestations being connected with bacterial activity.

The principal leaf and bark fungi are enumerated and brief notes are given on the following wood-destroying organisms: *Daedalea quercina*; *Fomes applanatus*; *F. connatus*, causing a heart rot of hickory and hard maple [*Acer saccharum*: see this *Review*, v, p. 266]; *F. igniarius* on oaks and apples; *Polyporus squamosus*, the causal organism of heart rot of maples; *P. sulphureus* on oaks; *Polystictus conchifer*, which is responsible for a slow rotting of elms; *Pleurotus sapidus*, *P. ostreatus*, and *P. ulmarius*, associated with heart rot of elms and hard maples; *Hydnum septentrionale*, semi-parasitic on hard maples and hickory; *Armillaria mellea*, occurring chiefly on conifer roots; and *Collybia velutipes*.

SPAULDING (P.) & RATHBUN-GRAVATT (ANNIE E.). **Longevity of the teliospores and accompanying uredospores of Cronartium ribicola Fischer in 1923.**—*Journ. Agric. Res.*, xxxi, 10, pp. 901–916, 1 graph, 1925. [Received April, 1926.]

The experiments reported in the present paper were carried out from 1st August to 10th October, 1923, at Warrensburg, New York, and from 10th to 31st October of the same year at Bethel, Vermont, with a view to supplementing the senior author's work in 1921 on the viability of the teleutospores of the white pine blister rust (*Cronartium ribicola*) [see this *Review*, ii, p. 4]. Besides the five species of *Ribes* included in the previous tests, collections of teleutospores were made from the leaves of *R. triste*, *R. glandulosum*, and *R. vulgare*. The leaves bearing the teleutospore columns were enclosed in mosquito nets and exposed in the open to all the variations of the weather, keeping them, however, sheltered from too much sun. The first few experiments indicated that pre-cooling, in itself, did not stimulate the subsequent germination of the teleutospores, but that sharp alternations of high day and low night temperatures had a marked stimulating effect on the germination. It is further stated that the spores germinated much better when floated on the surface of water in small glasses than when placed in the damp atmosphere of a moist chamber.

As in the 1921 tests, the teleutospores from the leaves of *R.*

nigrum were found to retain their viability for the longest period as they were still germinating well at the end of the experiments, i.e., after a lapse of 87 days. The shortest-lived (19 days) were those of one collection from *R. rotundifolium*, but it is pointed out that they were borne on leaves that had both surfaces completely coated with dew at the time of collection, so that partial germination had occurred in the columns, and the viability of the remaining teleutospores was unusually low. The longevity of the teleutospores from the other species ranged between these two limits. The teleutospores on naturally fallen leaves of *R. nigrum* lived 57 days when kept out of doors, thus indicating that infected leaves, even when lying on the ground, may be a source of pine infection for a prolonged period. It was further found that the time necessary for the germination of the teleutospores increases with their age, whether the material is kept dry indoors or exposed to the weather in the open.

Uredospores accompanying the teleutospores on the leaves remained viable for a maximum period of 59 days under the conditions of the experiments.

KÜSTER (E.). **Beiträge zur Kenntnis der panaschierten Gehölze. IX. Ueber enzymatische Panaschierung und die Weisspunktkrankheit beim Ahorn.** [Contributions to the knowledge of variegated trees. IX. On enzymatic variegation and the white spot disease of the Maple.]—*Mitt. Deutsch. Dendrol. Gesellsch.* (*Jahrb.*), xxxv, pp. 148–150, 2 figs., 1925.

A mottling of *Acer dasycarpum* leaves, apparently distinct from that due to the attacks of certain insects, has been observed in the Giessen [Hesse-Nassau] Botanic Garden. The upper side of the leaf blades is covered with innumerable dingy white spots, and the cells of the upper mesophyll layer are colourless. In some cases the spots merge into large pale areas, contrasting sharply with the green tissues along the veins. This phenomenon, which was particularly striking in the summer of 1925, is believed to be due to some metabolic disturbance which occurs quite independently of local external conditions.

HÖSTERMANN [G.] & NOACK [M.]. **Ueber das Ulmensterben am unteren Rhein.** [The dying-off of Elms on the lower Rhine.] —*Mitt. Deutsch. Dendrol. Gesellsch.* (*Jahrb.*), xxxv, pp. 287–289, 1925.

The essential points in this paper have already been noticed from another source [see this *Review*, v, p. 66].

MONIZ DA MAIA (R.). **Uma doença dos Eucaliptos de viveiro causado por um 'Botrytis'.** [A disease of seedling Eucalypts caused by *Botrytis*.]—*Revista Agronómica* [Lisbon], 4ª Sér., i, 1, pp. 23–24, 2 pl., 1924. [Received April, 1926.]

A necrosis of the stems of diseased *Eucalyptus globulus* sent from a nursery near Samora Correia, Portugal, to the Pathological Laboratory, Lisbon, in October, 1921, was found on examination to be associated with a species of *Botrytis* which was isolated and

grown on potato, on which numerous conidial fructifications and sclerotia were produced.

Inoculation experiments, made at the Laboratory of Forest Biology with conidia and sclerotia, produced the typical symptoms of the disease on healthy seedlings.

The occurrence of *Botrytis* in this nursery is attributed to its damp situation, with night mists which frequently persist until late in the morning and are followed by hot days, and to the density of the stand.

In 1922, specimens of *Eucalyptus* attacked by the same disease were received from the Forest Service at Coimbra.

HART (H. J. M.). **Wortelschimmel in Djaticulturen.** [A root fungus in Teak plantations.]—*Tectona*, xviii, 7, pp. 749–754, 3 pl., 1925. [English summary.]

In the forests of south Soerabaja (Java) a die-back of young teak (*Tectona grandis*) and other trees, e.g., *Swietenia macrophylla*, *S. mahogoni*, *Artocarpus integra* [*A. integrifolia*], *Eugenia cumini*, *Schoutenia ovata*, and *Schleichera oleosa*, has been observed since 1920 in the areas formerly occupied by *Ficus elastica*, and now largely overgrown by *Lantana camara* and *Imperata arundinacea* var. *koeningii*. The cause of the disturbance, which frequently occurs in rubber (*Hevea brasiliensis*), coffee, cacao, tea, and cinchona plantations, is believed to be a root fungus, originating in the *Ficus* roots left to decay in the ground. The only economic method of control appears to be to give the old *Ficus* land over to the villagers for the cultivation of agricultural crops for two to three years on condition that all *Ficus* stumps are removed, before replanting the sites with teak.

WIELER (A.). **Ueber Einwirkungen von Fabrikexhalationen auf die Holzgewächse.** [The effects of factory exhalations on woody plants.]—*Mitt. Deutsch. Dendrol. Gesellsch.* (*Jahrb.*), xxxv, pp. 102–111, 2 pl., 1925.

The work of previous investigators on the effects of factory exhalations on plant life is discussed, and the writer's researches on this subject in the Clausthal (Harz Mountains) district are recapitulated [see this *Review*, ii, p. 21]. In this region reafforestation with conifers is in progress, and so far the application of lime has given satisfactory results in counteracting the toxic effects of the acid exhalations in the soil.

BLAKE (E. G.). **Enemies of timber: dry rot and the death-watch beetle.**—xv + 206 pp., 10 pl., 12 figs., London, Chapman & Hall, 1925.

In the first part of this manual a brief account of the properties of timber and its liability to decay is followed by a description of the propagation and development of dry rot (*Merulius lacrymans*, *Coniophora cerebella*, and *Polyporus vaporarius*, the first-named being stated to be of paramount importance in England), and by a discussion of the problems of its prevention in new buildings and its eradication from old ones. The principles of construction are outlined with special reference to the prevention of dampness and the production of a free and complete circulation of air, the cardinal

points in the control of dry rot. Directions are given for the treatment of buildings in which the fungus has already gained a hold. The measures to be adopted in such cases include the removal of all infected flooring, skirting, panelling, and the like; thorough scrubbing of the walls beneath the floor; the application of a liquid disinfectant, e.g., Calvert's No. 5 carbolic acid or corrosive sublimate, to all exposed surfaces; the concreting of the site before replacing the floor; and the covering of any damp inside surfaces with asphalt or a thick coat of coal-tar and pitch.

RICHARDS (C. AUDREY). **The comparative resistance of eighteen species of wood-destroying fungi to zinc chloride.**—*Proc. Amer. Wood Pres. Assoc., 1925,* pp. 18–22, 1925.

The wood-destroying organisms previously tested for resistance to sodium fluoride [see this *Review,* iv, p. 579], with the addition of *Coniophora cerebella,* formed the subject of a similar experiment with zinc chloride. The reaction of the fungi to the two preparations is compared. *Lentinus lepideus* was the most susceptible to zinc chloride, growth being inhibited by a solution of 0·075 per cent., and *Polyporus schweinitzii* the most resistant, withstanding concentrations of over 0·6 per cent. *Fomes annosus* and *Schizophyllum commune* are the only organisms occupying the same positions (13th and 15th, respectively, in order of increasing resistance) in both lists. *C. cerebella* was intermediate between *Stereum fasciatum* and *Polystictus versicolor* in resistance to zinc chloride (0·3 per cent.). Smaller amounts of zinc chloride than of sodium fluoride were required to kill *Fomes pinicola, L. lepideus, Lenzites striata, Pleurotus ostreatus, Polystictus hirsutus,* and *Trametes pini* var. *abietis*; and larger quantities for the rest of the fungi used, with the possible exception of *Lenzites trabea. T. carnea* was found to be equally susceptible to both.

SCHANTZ (C.). **Wirtschaftlich notwendige Erfahrungen bei der Holzkonservierung.** [Economically necessary data in timber preservation.]—*Brennstoff-Chem.,* vii, 1, pp. 1–2, 1926.

The economic importance of timber preservation in Germany, with special reference to the treatment of telegraph poles, has already been discussed by the author [see this *Review,* v, p. 142]. In the present paper he describes a method of estimating the necessary quantities of coal-tar oil to be applied to structural timbers, &c., in order to obtain the maximum efficiency with the minimum expenditure.

The coal-tar oil employed for this purpose consists of high boiling distillates, of which 75 per cent. must have a boiling-point above 235°, while 6 per cent. of the constituents must be acids (chiefly the higher homologues of phenol, e.g., the cresols and xylenols). Naphthalene and its homologues must also be present. The antiseptic action of coal-tar oil, therefore, rests on a dual basis, namely, the toxicity of the phenols to insect and vegetable parasites and the water-repelling property of the remaining constituents. The latter is extremely important, since the soluble phenols are thereby retained in the wood and the absence of moisture at the same time inhibits insect and fungal life.

In the Rüping process [see this *Review,* iv, pp. 387, 388] only

a sufficient quantity of oil is used to cover the cell walls. Owing to the high degree of adsorption, this oil covering evaporates very slowly, but nevertheless it is essential to replace the loss thus sustained. This is effected by supplying the inner cells with an excess of oil, which gradually replenishes that on the outer walls as the latter is depleted.

On this basis it is possible to calculate the maximum adsorption of coal-tar oil for different kinds of wood. The specific gravity of pine wood is approximately 0·5, that of the wood substance after the air has been exhausted 1·5. In a cubic metre of wood weighing about 500 kg. the weight is represented by the wood substance, occupying only a third of the volume, while two-thirds are air spaces. Assuming that the wood consists of one-third sap and two-thirds heart wood (which is not susceptible to impregnation), there is $\frac{0{\cdot}667}{3} = 0{\cdot}222$ cu. m. vacuum to be filled with coal-tar oil. The specific gravity of coal-tar oil being 1·04 the quantity required would be 230 kg. (or 75 kg. for partial impregnation) per cu. m. Similar calculations may be made for beech and oak; the former, consisting exclusively of sapwood, can be impregnated throughout.

The duration of life of the impregnated wood depends on the quantity of preservative contained in a cubic metre. After a certain point, however, an increase in the amount of preservative only slightly augments the duration of life. Pine wood impregnated with coal-tar oil at the rate of 230 kg. per cu. m. has an average duration of life of 23 years, the corresponding period for 63 kg. per cu. m. being 18 years; for 75 kg., therefore, the duration of life may be estimated at about 20 years. This latter process is probably the most economical for pine timber, since it gives almost the maximum duration of life with a low expenditure of preservative.

Bateman (E.) & Henningsen (C.). **A theory on the mechanism of the protection of wood by preservatives. Part IV.—Toxic principles of creosote.**—*Proc. Amer. Wood Pres. Assoc., 1925,* pp. 22–28, 2 graphs, 1925.

The following conclusions have been drawn from an investigation [which is briefly described] on the toxic principles of creosote [see also this *Review,* iii, p. 617]. The essential toxic materials in coal-tar creosote may be divided into two groups, namely, the hydrocarbon oils boiling below 270° C. and the tar acids and tar bases boiling above this point. The former group comprises the essential toxic materials of ordinary creosote oil, and the latter those of high boiling distillates, such as carbolineum. In this case the hydrocarbons, although potentially very toxic, are rendered ineffective by their low solubility.

Three points of special importance were brought out by the writers' experiments with *Fomes annosus,* namely, (1) the immense reduction of toxicity consequent upon the removal of the tar acids and tar bases from the oil; (2) the close approximation to the original toxicity effected by the replacement of either the tar acids or the tar bases or both; and (3) the equal efficacy of beta-naphthol with the naturally occurring tar acids.

HOWALD (A. M.). **A one-movement process for impregnating timber with zinc chloride and petroleum.**—*Proc. Amer. Wood Pres. Assoc., 1925*, pp. 81–110, 4 figs., 1 diag., 2 graphs, 1925.

By the use of an emulsion of zinc chloride solution in petroleum fuel oils, timbers have been satisfactorily impregnated with oil and zinc chloride in one movement. Asphaltic residuum and distillate fuel oils are mixed in proportions to give a suitable viscosity varying from 45 to 65 seconds Saybolt at 180° F. This mixture is agitated with from 15 to 25 per cent. of a 10 to 40 per cent. zinc chloride solution, then pumped under high pressure (about 2,000 lb. per sq. in.) at 170° F. through an emulsifying valve. The natural asphaltic and resinous constituents of suitable fuel oils, e. g., heavy and light Mexican crudes, California crudes, and Caddo crude oil, have a protective action which renders the addition of an artificial stabilizer superfluous.

An average desirable treatment on the basis of present knowledge is 8 lb. oil (about 1 gall.) and ½ lb. zinc chloride per cu. ft. With petroleum oil at 4 cents per gall. and zinc chloride at 6 cents per lb. the cost of preservation is as follows: \$0·04000 for oil; \$0·03000 for zinc chloride; and \$0·00175 for power, interest, and depreciation; making a total of \$0·07175 per cu. ft. of timber.

No great changes from the usual conditions and processes of pressure impregnation are involved, but the customary temperature of 180° F. cannot be much exceeded.

Semi-industrial treatments, comprising 3,500 ties [railway sleepers], have been carried out in co-operation with the Atchison, Topeka, and Santa Fé Railway and the Grasselli Chemical Company at Somerville, Texas.

LONG (W. H.). **When is rot not rot?**—*Proc. Amer. Wood Pres. Assoc., 1925*, pp. 202–215, 1925.

The various treatments given to tie [sleeper] timbers in a series of experiments conducted at Albuquerque, New Mexico, may be grouped under three general heads: (1) the 'fir' treatment, for Douglas fir (*Pseudotsuga taxifolia*), Engelmann spruce (*Picea engelmanni*), cork-bark fir (*Abies arizonica*), and possibly white fir (*A. concolor*); (2) the western yellow pine (*Pinus ponderosa*) treatment; and (3) the Texas pine treatment for long-leaved and loblolly pine (*P. palustris* and *P. taeda*). All the ties were treated by the Rüping process with a mixture of 45 parts of creosote to 55 of petroleum, the duration being 10 to 12 hours in the case of group (1), 5½ hours in (2), and 4½ hours in (3).

The butt rots caused by *Polyporus schweinitzii* and *Echinodontium tinctorium* were sterilized by all the treatments in every kind of timber used. *Trametes pini* was destroyed in all cases except one spruce tie treated by the western yellow pine method. *P. ellisianus* was not completely destroyed in any of the yellow pine ties.

In a series of partially treated ties, *P. schweinitzii*, *P. ellisianus*, *T. pini*, and *E. tinctorium* developed in western yellow pine, and the first three on *P. taeda* and *P. palustris* also.

The question of using slightly infected ties is discussed, the conclusion being reached that the physical properties of such timber are not appreciably injured by small amounts (not exceeding 1½ in.

in diameter) of incipient rot. Many of the thousands of ties which are left to rot in the forests on account of slight decay could be used with advantage after suitable treatment, thereby effecting a most important saving in structural materials.

REX (E. G.). **Experiments on the control of black-leg disease of Cabbage.**—*Pennsylvania Agric. Exper. Stat. Bull.* 199, 23 pp., 10 figs., 1925. [Received April, 1926.]

The common formaldehyde and corrosive sublimate methods of disinfecting seeds failed to give satisfactory control of cabbage blackleg (*Phoma lingam*), which is causing much damage in Pennsylvania, but a reduction of infection from 40·5 to 15 per cent. was obtained by 1 hour's immersion in 0·5 per cent. semesan, preceded by two hours' soaking in water at room temperature. Half-an-hour's immersion in 0·5 per cent. uspulun at a temperature of 112° to 122° F. also gave promising results. The hot water (112°) treatment [see this *Review*, iv, p. 459] controlled the disease but caused a drastic reduction of germination of the seed.

Evidence is stated to point to the overwintering of the fungus on host refuse, with consequent reinfection of the next year's crop. This risk can be greatly reduced by crop rotation.

There is some indication of resistance in the Midseason Market variety, and the development of resistant varieties is considered to offer the most practical solution of the control problem.

HAENSELER (C. M.). **Pea root rot studies.**—*Forty-fifth Ann. Rept. New Jersey Agric. Exper. Stat. for the year ending June 30, 1924*, pp. 403–414, 1 pl., 1925. [Received March, 1926.]

The results of investigations on the destructive root rot of peas occurring in certain parts of New Jersey indicate that the most serious type of the disease is associated with the presence of *Aphanomyces euteiches* [see this *Review*, iv, p. 508], although the organism has not yet been isolated from infected material. One strain of *Fusarium* (F 26) and the sterile fungus (F 28), which gave positive results in previous inoculation experiments [see this *Review*, iv, p. 714], proved to be only moderately parasitic in a new series of tests. Two isolations of *Pythium* from peas and one from spinach (all believed to be identical) were actively parasitic on the roots of inoculated peas.

In pots kept at constant moistures of 20, 40, and 60 per cent., the amount of infection with F 26 was 39, 55·5, and 39 per cent., respectively. In pots with the moisture fluctuating between 40 and 20 and 60 and 20 per cent., there was only a trace of infection, while between 60 and 40 per cent., 44·4 per cent. of the plants developed symptoms of the disease. At 60 and 80 per cent. soil moisture an agar culture of *Pythium* caused rotting in 100 per cent. of the seeds.

Young plants were shown by experiments to be less susceptible to the sterile fungus type of root rot than older individuals.

Greenhouse experiments confirmed field observations as to the greater severity of the disease in consecutive plantings of peas.

Fertilizer, lime, and sulphur applications failed to influence the extent or development of root rot.

None of the forty varieties tested showed sufficient resistance to yield advantageously on heavily infected soils. Individual selections of the World's Record and Pilot varieties gave the most promising results.

Gardner (M. W.). **Bacterial spot of Cowpea and Lima Bean.**—*Journ. Agric. Res.*, xxxi, 9, pp. 841–863, 6 pl., 1925. [Received March, 1926.]

The bacterial spot disease of cowpea (*Vigna sinensis*), first noted in Indiana in 1919 [see this *Review*, ii, p. 485], and the morphological and cultural characters of the causal organism, *Bacterium vignae*, are fully described in this paper. The latter is remarkable for its wide range of leguminous hosts [see this *Review*, v, p. 216] and only one variety of the susceptible species, namely, Henderson's Bush Lima bean [*Phaseolus lunatus*], has shown some resistance.

Infection readily occurs on the leaves without wounding, the organism remaining between the cells of the mesophyll but penetrating the vessels, where a copious development of bacterial slime may result. When cowpea pods are attacked the seed may become infected, and such seed gives rise to diseased seedlings.

As control measures the use of seed two or three years old or from healthy pods, and crop rotation, are recommended.

Alcock (Mrs. N. L.), M'Intosh (A. E. S.), & Wallace (G. B.). **The control of Onion smut.**—*Scottish Journ. of Agric.*, ix, 1, pp. 1–5, 1926.

Onion smut (*Urocystis cepulae*) has been known in the south of Scotland for a number of years and the authors have carried out a series of experiments in its control by formalin on leeks at Edinburgh and on onions in East Lothian. Two strengths were used, namely, $2\frac{1}{2}$ and $1\frac{1}{4}$ oz. formalin to 1 gall. water, applied in both cases at the rate of a gallon to each 60 yds. of furrow, which is equal to a little over 200 galls. per acre with the drills one foot apart. The disinfectant was poured in the furrow at a slow rate of walking and the seed sown immediately.

With the leeks the stronger solution gave the better results whether as regards smut control, number of surviving plants, or weight of harvested produce. The most striking effect, indeed, was the marked difference in the number and average size of the plants in the treated and untreated plots. The cost of treating an acre with the $2\frac{1}{2}$-oz. solution was about 30*s*. 0*d*. for the formalin, apart from the cost of labour.

Both solutions gave approximately equal results on onions and the treatment had the same effect in increasing the vigour of the plants as with leeks.

In neither case was full control obtained, but the authors point out that in cases of severe infestation it would probably take several years to reduce the amount of disease down to a degree at which complete protection might be furnished by the treatment.

CAMPANILE (GIULIA). **Sulle septoriosi del Sedano.** [On Celery blight.]—*Boll. R. Staz. Pat. Veg.*, N.S., vi, 1, pp. 44–71, 1926.

Considerable and increasing losses are caused to growers of celery under irrigation in the outlying districts of Rome by blight (*Septoria petroselini* var. *apii*) [*S. apii*], plants affected with which become dwarfed and are of low market value.

In cultures of the fungus obtained by the author on celery decoction agar, growth was better on a neutral or alkaline medium than on an acid one, but the latter favoured pycnidium formation while conidia were chiefly produced on alkaline media. The pycnospores germinate readily in 1 per cent. glucose solution, sometimes bearing secondary, non-septate spores or fragmenting into several spores. The development of the germ-tubes was better at temperatures of 9° to 14° than at 25° C. Germination was inhibited by a 1 in 20,000 solution of copper sulphate. Penetration of the leaf tissue has been observed to occur either through the stomata or, more commonly, through the epidermal cells.

The fact that moisture is essential for infection has been confirmed by the author's observations. It is the custom near Rome usually to have two periods of harvesting the celery crop, one in the winter and the other in the summer, and the damage caused by the disease is often much greater in the former. Plants badly attacked during the winter, if allowed to remain in the ground instead of being marketed, may, when growth is resumed, become practically free from the fungus owing to the effect on its development of the hot dry weather as summer approaches. In the autumn and spring months the drops of moisture that collect at the apex of the leaves appear to favour infection, which often begins at the leaf tips. Plants growing under trees are less frequently attacked than those in the open, and tests have shown that defoliated plants are more susceptible than those which retain their leaves. It is recommended therefore to limit pinching off leaves to the time immediately following transplanting.

Various measures are suggested for the control of this disease. Seed disinfection with formalin or uspulun is recommended, but this process may be omitted if old seed is used, since the conidia of *S. apii* show a decidedly reduced germinability in the second year and do not survive for a third season, whereas celery seed retains its capacity for germination up to at least the fourth year. Use of even two-year-old seed is fairly safe, as very few spores of the fungus are then capable of reproducing the disease.

Investigators in other countries have indicated that the yellow celery varieties are more susceptible to attack than the green, but the susceptibility of the different Italian varieties has not yet been determined.

MALABANAN (D. B.). **Anthracnose of Pepper.**—*Philipp. Agric.*, xiv, 8, pp. 491–501, 2 figs., 1926.

Anthracnose of pepper (*Capsicum annuum*) [see this *Review*, iv, p. 182] is stated to be usually of minor economic importance in the Philippines. Plantings made during the dry season are liable to attack at the beginning of the rains, while those made in the wet season generally remain free from the disease.

The first symptom is the appearance of small yellow or discoloured spots on any part of the fruit or leaves. The affected areas gradually expand and become depressed, leaving more or less circular lines of demarcation between the healthy and diseased portions. With increasing age the spots turn greyish or brown, and black specks, concentrically arranged, appear on the lesions. In dry weather the spots are dry and papery and they may accelerate the wilting and dropping of the fruit. Rapid decay and falling of the fruit, leaves, and flowers may take place during the rainy season.

The circular, erumpent acervuli measure 56 to 100 μ on the leaves and 50 to 250 μ on the fruit. Setae occur and are almost black (paler at the distal end), two- to six-septate, thick-walled, tapering, and measure 39·3 to 192·4 by 4·39 to 7·32 μ. The unicellular, hyaline, falcate conidia, tapering at both ends, measure 23 to 31·1 by 3·66 to 3·93 μ. Germination occurs in two to five hours by means of a germ-tube, which in turn develops chlamydospore-like structures after six hours to three days according to the medium.

The fungus grows readily on most media, forming a white mass of aerial hyphae followed by the production of pink (later black) sclerotial bodies bearing the setose acervuli.

The fungus is a weak parasite which can only attack plants with a diminished power of resistance. Once admission is gained, however, the organism rapidly spreads through the tissues, especially if favoured by warm, moist weather. Sweet pepper varieties of the fleshy Ruby King type are susceptible to the disease, while the hot ones are very resistant.

Inoculations produced the characteristic symptoms of anthracnose on unwounded tomato and eggplant [*Solanum melongena*] fruits, and caused a storage rot of tomato, pepper, eggplant, squash (*Cucurbita pepo*), and Lima bean [*Phaseolus lunatus*].

The fungus concerned has not been definitely identified, but is believed to be *Colletotrichum nigrum*.

Adequate control can be obtained by the adoption of suitable planting methods, sanitary measures, and seed selection.

PÉE-LABY (E.). **L'invasion du mildiou en 1925. Résistance de quelques hybrides producteurs.** [The invasion of mildew in 1925. Resistance of certain non-grafted hybrids.]—*Rev. de Vitic.*, lxiv, 1646, pp. 31–33, 1926.

An especially severe attack of vine mildew [*Plasmopara viticola*] occurred in France during 1925 [see this *Review*, iv, p. 651] and accentuated the importance of replacing the old susceptible French stock by carefully selected resistant hybrids.

The author has attempted a classification of selected black and white hybrids according to their degree of resistance to mildew, namely, (1) those requiring neither copper sulphate nor sulphuring [i. e., resistant also to *Uncinula necator*]; (2) those resistant except in years of unusually severe attack, such as 1925; (3) those requiring few treatments and distinguished by heavy yields of a good wine-making quality. Lists of hybrids, chiefly of the Seibel collection, but also including under (1) Couderc Nos. 7120, 4401, and 4101, Baco No. 1, and Malègue No. 2049–3 (all black grapes), are given.

Rousseau (I.). **Sur l'apoplexie de la Vigne.** [On the apoplexy of the Vine.]—*Prog. Agric. et Vitic.*, lxxxv, 5, pp. 117–118, 1926.

The good effect of treating grape vines against apoplexy [*Fomes igniarius* or *Stereum hirsutum*: see this *Review*, iii, pp. 314, 630] with arsenic compounds is illustrated in this brief note by the case of a vineyard of 2,000 stocks in France, in which 50 plants had been killed in 1921. After treatment with the arsenical insecticide pyralion in 1921 and in 1922, the incidence of the disease fell to 2 and 1 stocks, respectively, and it rose to 3 cases in 1923 and 5 cases in 1924, when the vineyard was not treated. In 1925 the vineyard was treated with paratoxil and no new cases were recorded. The latter preparation is stated to give excellent results in the control of this disease.

Walters (E. A.). **Report on the Agricultural Department, St. Lucia, 1924.**—30 pp., 1926.

In the section dealing with the control of fungous diseases (pp. 10–11), an account is given of the recent survey made by S. F. Ashby in connexion with the Panama disease of bananas (*Fusarium cubense*), which is particularly fatal to the variety Gros Michel and was observed in the nurseries of St. Lucia in 1924. The system of planting sections after examination for freedom from the disease was found to be successful in reducing infection, and this system is being extended to all new plantations where the co-operation of the Agricultural Department is required. It is considered of the utmost importance that only disease-free sections should be planted on uninfected land. The higher areas and virgin forest lands are practically free from disease, and it is recommended therefore that on no account should these lands be planted with bananas from the established estates and coastal areas in which, with few exceptions, Panama disease is present, probably introduced originally from overseas.

A bud rot, apparently due to *Phytophthora*, was observed on coco-nuts, and directions were given to burn the upper part of the diseased palms. 'Little-leaf' disease [see this *Review*, iv, p. 464] was found in several coco-nut plantations; it is characterized by dwarfing, distortion, and crumpling of the young leaves and constrictions of the trunks, due to debility caused by food shortage. Palms in favourable situations may outgrow the disease, particularly if aided by improved drainage and manuring, but if neglected they are liable to succumb to a secondary bud rot. Opening the heart leaves and drenching with tobacco extract or diluted Jeyes fluid [a crude carbolic preparation] is recommended for the milder cases.

No mosaic disease of sugar-cane has yet appeared in the island, largely on account of the strict examination and treatment or destruction when necessary of all plants introduced.

The root disease of cacao caused by *Rosellinia pepo* has been restricted by burning all diseased roots and isolating the infected areas by deep trenching. Black pod rot (*Phytophthora faberi*) occurs in most cacao estates during prolonged wet weather.

ADAMS (J. F.). **Plant disease survey of economic crops in Delaware, during 1925.**—*Delaware State Board of Agric.*, xv, 28 pp., February, 1926.

This report contains notes on the prevalence and relative importance during 1925 of the principal diseases of economic crops in Delaware, classified as follows: orchard and small fruits; field and vegetable crops; cereal and forage crops; and ornamentals. Control measures are indicated in certain cases not already covered by other publications, and some climatological data are given. On the whole, the incidence of disease was much slighter in 1925 than in 1924.

Plant pathology and physiology.—*Thirty-eighth Ann. Rept. Texas Agric. Exper. Stat. 1925*, pp. 32–34, [? 1925. Received April, 1926.]

During the period from 1st September, 1924, to 31st August, 1925, an extensive study was made of cotton root rot [*Phymatotrichum omnivorum*: see below, p. 426]. In the central regions of Texas the vine *Ipomoea trichocarpa* is stated to be by far the most important summer and winter carrier of the disease. The cumulative effects of sulphur treatment (10,000 lb. per acre) reduced the incidence of infection to a minimum, but were not beneficial to the cotton. Large numbers of spores of *P. omnivorum* were found in irrigation ditches a few days after irrigation and also in lucerne fields where sunlight was excluded. For the first time, successful germination of the spores was obtained by the removal of a waxy sheath which normally prevents them from absorbing water. The development of the fungus was found to be completely inhibited by 0·20 per cent. of normal hydrochloric acid, 0·21 per cent. of normal sulphuric acid, or 5·50 per cent. of normal sodium hydroxide.

Blossom-end rot of tomatoes is believed to be caused by lack of moisture in the soil. Wilt (*Fusarium*) [*lycopersici*], on the other hand, is prevalent in all soils and climatic conditions, and can be controlled only by careful crop rotation and the use of healthy seed.

A new spinach wilt, first reported in 1923–4, has been definitely ascertained to be due to *F. solani*.

CLINTON (G. P.). **Botany.**—*Forty-eighth Ann. Rept. Connecticut Agric. Exper. Stat. for the year 1924* (*Bull.* 264), pp. 207–210, 1925. [Received April, 1926.]

Besides matters already noticed in this *Review* it is stated that spraying has uniformly given better control of the fungous diseases of apple and peach than dusting. Further tests with combinations of sprays and dusts are planned.

The best results in the control of celery blights [*Cercospora apii* and *Septoria apii*] were given by 4–4–50 Bordeaux mixture.

Selected maize seed gave a better stand, a higher yield, and greater freedom from ear and root rots [*Gibberella saubinetii*, *Diplodia zeae*, *Fusarium moniliforme*, and *Cephalosporium acremonium*] than unselected [see this *Review*, iv, p. 732].

NEAL (D. C.). **Annual Report of Plant Pathology Department.**—*Thirty-seventh Ann. Rept. Mississippi Agric. Exper. Stat. for the fiscal year ending June 30, 1924*, pp. 28–31. [Received April, 1926.]

The results of experiments in the control of pecan scab [*Fusicladium effusum*] indicate that the most effective fungicide for this purpose is Bordeaux mixture 4–4–50 or 2–4–50 [see also this *Review*, v, p. 44]. Applications made during May, July, and August increased the yields over the controls from 7 to 10 lb. of marketable fruit per tree.

A pathological and physiological study of anthracnose of lucerne (*Colletotrichum trifolii*) [see this *Review*, iv, p. 82] has been in progress since 1922. The following varieties and strains have shown good resistance to the disease: Capetown, Africa; 12946 and 12990; Disco 12; Cossack 1 and 2; and Grimm 1 (*a*), 1 (*b*), and 2. Greenhouse inoculation tests have shown that the fungus is pathogenic to red clover.

An anthracnose disease, definitely ascertained to be due to a species of *Colletotrichum*, has been observed in the Delta region on Hubam clover [*Melilotus alba* var. *annua*].

CRAWFORD (R. F.). **Some common New Mexico plant diseases.**—*New Mexico Agric. Exper. Stat. Bull.* 148, 25 pp., 1925. [Received April, 1926.]

The principal fungous diseases of the more important cultivated plants of New Mexico are described in popular terms with brief directions for their control under local conditions. Notes are given also on the various manifestations of chlorosis and mosaic.

KÜSTER (E.). **Regenerationserscheinungen an Bakteriengallen.** [Regeneration phenomena in bacterial galls.]—*Flora*, N.F., xx, 3, pp. 179–197, 12 figs., 1926.

The author describes various adventitious growths resulting from infection by *Bacterium tumefaciens* on tomato, dandelion (*Taraxacum officinale*), variegated *Pelargonium*, and elm.

On tomato he observed that the protuberances on the surface of the galls were covered with pluricellular hairs, frequently terminating in a rounded apex resembling that of a gland; in some cases teratologically deformed, split hairs were noticed.

On dandelion roots, which are known to be prone to give adventitious and often teratological growths on cut roots placed under suitable conditions, inoculation with *Bact. tumefaciens* results in a much more copious production of these abnormal organs, including dichotomous leaves, ascidia, local reduction of the leaf blade, twin leaves, winged leaves, and other malformations of the foliage [which are described and figured]. Some of these types have never been observed by the author on non-inoculated roots.

On variegated *Pelargonium* shoots the large tumours resulting from inoculation with *Bact. tumefaciens* generally develop adventitious shoots, which are so densely clustered that the surface of the gall appears as a mass of green buds. Nearly all the adventitious organs were entirely free from variegation. This is the result which would be expected from a consideration of Baur's periclinal

chimera theory (*Zeitschr. Indukt. Abstamm. u. Vererbungslehre*, i, p. 330, 1909), according to which adventitious shoots are derived from cells of the green core of the variegated plant. By inoculation with *Bacterium tumefaciens* it is possible to develop shoots which differ from the periclinal mother plant, inasmuch as only the central component participates in their origin. It is suggested that it would be of great interest to apply this method to the forms of *Pelargonium* made use of by Bateson in his experiments on periclinal chimeras (*Journ. of Genetics*, vi, p. 75, 1916; xi, p. 91, 1921).

The elm shoots used in these experiments (chiefly from a variety with variegated leaf margins) reacted to inoculation with *Bact. tumefaciens* in a similar manner to the *Pelargonium*.

LACEY (MARGARET S.). **Studies in bacteriosis. XIII. A soft rot of Potato tubers due to Bacillus carotovorus and a comparison of the cultural, pathological and serological behaviour of various organisms causing soft rots.**—*Ann. of Appl. Biol.*, xiii, 1, pp. 1–11, 1926.

The parallel studies reported in the present paper were made during the summer of 1924 on (1) a strain of *Bacillus carotovorus* isolated from a potato sent by a potato grower [locality not indicated] as a sample of a soft white rot that, according to his report, attacked about 10 per cent. of his crop, and extensively destroyed the tissue inside the vascular ring, leaving the outer tissue unaffected; (2) a strain of *B. phytophthorus* obtained from Dr. Appel in 1924; (3) a strain of *B. carotovorus* isolated from rotted violet plants in 1921; (4) *B. solanisaprus* obtained from Washington through the National Collection of Type Cultures, Lister Institute, [London]; (5) a strongly pathogenic strain of *B. carotovorus* isolated by Bewley from rotted tomato stems; and (6 and 7) two cultures from Erwin Smith through the Lister Institute, one of which was a strain of *B. phytophthorus* and agreed very closely with Dr. Appel's strain, and the other agreed culturally and serologically with the Washington strain of *B. solanisaprus*. Finally, in the spring of 1925 two strains of soft-rotting organisms of the *B. carotovorus* group were isolated from rotted *Richardia* corms, and in addition, a few other strains of soft-rotting organisms were included in the serological tests.

Cultural, pathological, and serological tests [the results of which are shown in tabular form], show that a close relationship exists between the three species *B. carotovorus*, *B. solanisaprus*, and *B. phytophthorus*, but that there are sufficiently marked and constant differences to warrant their continued separation into different species. *B. phytophthorus* can be distinguished culturally from *B. carotovorus* or *B. solanisaprus* by its production of acid and gas in maltose broth, its behaviour in Uschinsky's solution, its rapid clearing in Fermi's solution and in saccharose broth, the absence of diastatic action, and the failure to grow at 37° C. As regards pathogenic behaviour, the constant jet-black pigmentation of tissues attacked by *B. phytophthorus* easily distinguishes this from *B. carotovorus* or *B. solanisaprus* infections. The two latter species would appear to be more closely allied, but they can be distinguished culturally by their behaviour in Uschinsky's and Fermi's solutions,

and by the acid and alkali production in sugar peptone water. The rot caused by *B. solanisaprus* is more watery, and the tissues are more browned than in that caused by *B. carotovorus*. The serological tests showed that although there is a common group agglutinin, the species can be separated by serum agglutinations which agree with Dr. Berridge's chemical agglutinations [see next abstract] in the grouping of the different strains tested.

Berridge (Emily M.). **Studies in bacteriosis. XIV. Chemical agglutination as a means of differentiating bacterial species causing soft rot of Potatoes and other vegetables.**—*Ann. of Appl. Biol.*, xiii, 1, pp. 12–18, 1926.

The chemical agglutination tests reported in the present paper were made with the same strains of *B. phytophthorus*, *B. carotovorus*, and *B. solanisaprus* as included in Miss Lacey's work [see foregoing abstract]. The results, some of which are given in tabular form, indicate that such tests are as reliable as serum agglutination tests within this group of bacteria. They also show that *B. solanisaprus* and *B. phytophthorus* are different organisms, and that both are closely related to *B. carotovorus* which, in these reactions, takes an intermediate position between the two.

Klemm (M.). **Zur phytopathologischen Untersuchung von Samen.** [Note on the phytopathological examination of seeds.]—*Pflanzenbau*, ii, 15, pp. 242–243, 1926.

The examination of cereal seeds on the basis of the Russian methods described by Dorogin [see this *Review*, v, p. 313] is advocated for use by German agricultural experiment and plant protection stations, seed companies, and the like. The table showing the Russian method of analysis of the various fungous diseases is reproduced.

Clark (J. A.), Martin (J. H.), & Stakman (E. C.). **Relative susceptibility of spring Wheat varieties to stem rust.**—*U.S. Dept. of Agric. Circ.* 365, 17 pp., 2 figs., 1926.

From 1919 to 1924, inclusive, field experiments to test the comparative resistance to black stem rust (*Puccinia graminis tritici*) of 33 varieties of spring wheat, were carried out at 39 different stations in the United States and Canada. Heavy rust infection occurred at most of these stations each year.

The results [given in tabular form] indicate that the durum wheats are much more resistant than the hard red spring wheats, especially the varieties Pentad, Monad, Acme, and Nodak. Of common wheats Kota, and a few hybrids such as Kota × Marquis (C.I. No. 6898), Reliance, Marquillo, and Progress, are more resistant than the extensively grown Marquis, while the latter is better than Haynes Bluestem and Red Fife, which should be largely abandoned. Most of the resistant varieties mentioned have some agronomic or commercial defects, but Kota and Nodak should be more extensively grown in the Dakotas, Marquis or Kota in Minnesota and Montana, and Mindum as a durum wheat under conditions of severe rust. The two varieties of spring emmer, Khapli and Vernal, are nearly immune from rust.

A brief description is given of the rust-resistant and important commercial durum and common wheat varieties used in these experiments.

KIGHTLINGER (C. V.) & WHETZEL (H. H.). **Second report on dusting for cereal rusts.**—Abs. in *Phytopath.*, xvi, 1, p. 64, 1926.

The writers' second series of experiments in the control of wheat and oat rusts by dusting with sulphur [see this *Review*, v, p. 219] have again given satisfactory results. The total increase on twenty rod-square plots of winter wheat affected by leaf rust [*Puccinia triticina*] only, was 18·5 per cent. (or 6·6 bushels per acre), while the average reduction of infection was 48·2 per cent. The corresponding increase on twenty plots of two square rods each of oats, affected by both leaf [*P. lolii*] and stem rust [*P. graminis*], was 19·6 per cent. (or 8·6 bushels per acre), and the average reduction of infection 37·9 per cent. There was some indication of a decrease in yield as a result of excessive applications of sulphur dust.

LAMBERT (E. B.) & STAKMAN (E. C.). **Effect of sulphur dust on the development of black stem rust of Wheat in a natural epidemic.**—Abs. in *Phytopath.*, xvi, 1, pp. 64–65, 1926.

The results of experiments conducted in Minnesota in 1925 in the dusting of wheat with precipitated sulphur at the rate of 30 lb. per acre for the control of black stem rust [*Puccinia graminis*] supported Kightlinger's favourable observations [see preceding abstract] on this method of treatment. Time of application is a most critical factor. In some experiments, one application practically controlled the disease in spite of a heavy natural epidemic, while in others five applications were almost ineffectual. The efficacy of the sulphur does not appear to persist long after application, which should be made just before a spore shower. In the hard red spring wheat region, under epidemic conditions, it would be necessary to begin dusting when the grain is in flower, or earlier, and continue till the hard dough stage.

GAINES (E. F.) & SINGLETON (H. P.). **Genetics of Marquis × Turkey Wheat in respect to bunt resistance, winter habit, and awnlessness.**—*Journ. Agric. Res.*, xxxii, 2, pp. 165–181, 3 graphs, 1926.

Three distinct types of resistance to bunt (*Tilletia tritici*) in wheat varieties have been observed at the Washington Agricultural Experiment Station [see this *Review*, iv, p. 405]. The first is that of the resistant winter wheat, represented by Turkey, which becomes quite immune when spring sown; the second that of the wheat possessing the same relative resistance or susceptibility whether autumn or spring sown; and the third that of the resistant spring wheat (Marquis) which is susceptible when autumn sown.

Transgressive inheritance occurred in both the autumn and spring sowings in the F_3 generation of the cross between Marquis and Turkey. Evidently the resistance of the parents is caused by different factors. A correlation of $0{\cdot}711 \pm 0{\cdot}027$ was obtained between the amount of bunt produced by the autumn sown and

spring sown F_3 families, indicating that the factors causing resistance in the autumn sowing are also operative in the spring. Resistance in the cross between Marquis and Turkey appears to be caused by two factors, the one carried by Turkey being much more 'prepotent' than that carried by Marquis. The later ripening plants of the F_2 and F_3 generations were more resistant than the early ones.

The awned F_3 families were somewhat more resistant than the awnless ones, but there is little or no indication of any linkage between awns and resistance.

GASSNER (G.). **Die Feststellung der Schädigung des Saatgutes durch Beizmittel.** [The determination of the injury to seed-grain by disinfectants.]—*Zeitschr. für Pflanzenkrankh.*, xxxvi, 1–2, pp. 25–41, 1926.

Discussing the various factors affecting the estimation of the chemotherapeutical value of fungicides, the writer considers that Friedrichs attaches an exaggerated importance to the question of the origin of the seed [see this *Review*, iv, p. 493]. Much more important in this connexion is the increased susceptibility of the grain to chemical injury as a result of damage by threshing.

The factor of paramount importance, however, in the determination of the chemotherapeutical value of a given fungicide is the temperature of the germination medium [see also this *Review*, v, p. 154]. In an earlier paper [see this *Review*, ii, p. 555] the writer recommended the maintenance of a uniform temperature of 15° C. According to an unpublished statement by Lang, the deleterious effects, e. g., of formalin, can only be gauged at low temperatures (round about 10°), but this method presents various difficulties in application, and is further unsuited to the chemotherapeutical estimation of mercurial preparations.

A series of experiments [the technique of which is described] was carried out with wheat seed grain of the Strube's General v. Stocken variety to test the effect of varying temperatures on the action of different concentrations of formaldehyde, uspulun, and germisan. The grain was germinated (*a*) on filter paper and (*b*) on soil.

It was apparent from the results of the experiments [which are presented in tabular form] that the injury to the seed varied greatly according to the temperature of the germination bed. Formaldehyde caused much greater damage at low than at high temperatures, whereas with mercurial preparations the reverse was the case. With formaldehyde approximately the same values were obtained on filter paper and on soil, while with uspulun and germisan the fluctuations of germination due to differences in temperature were much more pronounced on soil than on filter paper. The following values were determined for the *dosis toxica*, assuming that a drop below 90 in the value of the quotient of $100\,x/y$, where $x =$ the germination percentage divided by the retardation of germination (in days) of the treated grain, and $y =$ the same of the control, represents the first definite signs of injury. (1) Formalin: (*a*) on filter paper at temperatures of 5° and 20° = 0·08 and 0·1 to 0·12 per cent., respectively; (*b*) on soil = 0·08 and 0·1 per cent. (2) Uspulun: (*a*) on filter paper at temperatures of 5° and 20° = 0·4 to 0·5 and 0·25 to 0·3 per cent., respectively; (*b*) on soil = 1·5 to 1·7

and 0·2 per cent. (3) Germisan: (*a*) on filter paper at temperatures of 5° and 20° = 0·35 to 0·4 and 0·25 per cent., respectively; (*b*) on soil = 1·5 and 0·15 to 0·2 per cent.

The paper concludes with a theoretical discussion of the factors involved in the causation of injury to the grain, and of the relation of temperature to the physiological processes of germination. In view of all the facts the writer maintains that an average temperature of 15° is the most suitable for chemotherapeutical tests.

LINDFORS (T.). **Betning av vårutsädet.** [Disinfection of spring seed.]—*Landtmannen*, ix, 8, pp. 133–135, 1926.

The comparative efficacy of the various fungicides used in Sweden is briefly discussed. Uspulun dust is effective against *Fusarium* on cereals; unreliable in the control of bunt of wheat [*Tilletia tritici* and *T. levis*], covered smut of oats [*Ustilago levis*], covered smut of barley [*U. hordei*], and stripe disease of barley [*Helminthosporium gramineum*]; and useless against loose smut of oats [*U. avenae*]. In the 1925 tests, 20 to 30 minutes' immersion in 0·25 per cent. germisan completely controlled stripe disease, which affected 24 per cent. of the barley plants in the untreated rows. Excellent results were also obtained by this method against loose and covered smut of oats, covered smut of barley, and *Fusarium*. Sprinkling with 0·75 per cent. germisan was ineffective. Uspulun in its liquid form has also given good control of the above-mentioned diseases (except loose smut of oats), but one hour's immersion is required for the complete elimination of stripe disease. For the control of loose smut of oats, 20 minutes' immersion in a mixture of corrosive sublimate and formalin is recommended. This mixture consists of 100 gm. of corrosive sublimate in 100 l. of water to which is added 0·25 l. of 40 per cent. formalin. The mixture is on sale in Sweden under the name of sublimoform or havrefusariol. Tillantin C and urania [see this *Review*, v, p. 114] have given good results in the control of stripe disease of barley.

The writer's experiments have so far given no support to the view that a definite stimulatory action is produced on the seed by the various chemicals, apart from their fungicidal properties.

GRAM (E.). **De sidste Aars Afsvampningsundersøgelser.** [The last years' disinfection experiments.]—Reprinted from *Sjaellands Stifts Landbrugstidende*, 4, 4 pp., 1926.

The author gives a brief historical review of the use of seed disinfectants in agriculture, with particular reference to the recently introduced mercurial compounds and dry dusts. Of the former, uspulun has not been widely adopted in Denmark on account of its high cost and unreliability in controlling stripe disease of barley [*Helminthosporium gramineum*] and cereal smuts. Dusting, however, especially for barley and beet seed, is likely to be widely adopted, while the advantages of doing away with the necessity for immediate sowing and of protection from reinfection are very manifest also in the case of wheat.

The results obtained by Schaffnit in the control of *Calonectria graminicola* on rye by various dusts are cited [see below, p. 419], and the technique of dusting is briefly discussed.

Some particulars are given of the disinfection experiments carried

out in Denmark during 1924. Both wheat and rye yields were greatly increased by treatment with mercurial preparations, and in the numerous experiments with barley, sprinkling with germisan, tillantin C, and (in a few cases) corrosive sublimate or dan [see this *Review*, iv, p. 345] gave good results in the control of stripe disease. It has been shown that both germisan and tillantin C should be applied at the rate of 75 rather than 60 gm. per 100 kg. of grain in order to secure absolutely reliable results. In six tests in 1924, and in forty in 1925, barley seed treatment with germisan or tillantin C gave an increased yield.

Much interest is stated to have been shown by farmers all over Denmark in the new methods of treatment, and the solution of the various economic problems connected with their adoption will be for some time one of the foremost activities of the Danish agricultural organizations.

GRAM (E.). **Afsvampningsforsøg udførte af landboforeninger i Danmark i aaret 1925.** [Disinfection experiments conducted by agricultural organizations in Denmark in the year 1925.]—4 pp., Copenhagen, Nielsen and Lydiche, 1926.

The following points, in addition to those already noticed [see preceding abstract], are of interest. In the experiments with wheat the mercurial preparations (dan II and IV, germisan, uspulun, weizenfusariol, and tillantin C) gave uniformly more reliable results as regards increase of yield than copper carbonate dust or copper sulphate.

Both germisan and tillantin (sprinkling) produced a noticeable increase in the barley yields and generally gave good control of stripe disease [*Helminthosporium gramineum*], though up to 1·4 per cent. infection was observed with germisan and 3 per cent. with tillantin. In the one test in which it was used against this disease, copper sulphate (steeping in ½ per cent. solution) gave the highest yield of grain. Dan V and No. 225 dust (Magdeburg) also gave promising results.

In addition to germisan and tillantin, dan V and No. 225 increased the beet yield.

SAMPSON (KATHLEEN) & DAVIES (D. W.). **Some experiments on the control of bunt of Wheat by copper carbonate and other chemicals, including data on the growth and yield of treated and untreated grain.**—*Welsh Journ. of Agric.*, ii, pp. 188–212, 1926.

The results of five comparative experiments at the Welsh Plant Breeding Station, Aberystwyth, in 1923–1925, in which wheat seed grain was treated against bunt (*Tilletia tritici*) with various preparations [see this *Review*, iv, p. 406], showed that the best control was given by dehydrated copper sulphate and high grade samples of copper carbonate (containing about 50 per cent. of copper), applied at the rate of 2 oz. per bushel of grain. Dusts containing lower percentages of copper were more effective when applied at the rate of 4 oz. per bushel. Uspulun and germisan (steeping in 0·25 per cent. solution for one hour) gave approximately the same control as the better grades of copper carbonate, while two

formalin solutions (1 in 320 and 1 in 480) were almost equally effective, although the stronger solution is liable to injure the grain.

The actual results, given in tabular form, can be summarized as follows. Spring sown wheat in 1923: untreated 10.44 per cent. bunt; dehydrated copper sulphate dust 0·00; copper carbonate dust A (54·26 per cent. copper; 3·5 gm. powder to 4 lb. grain = 2 oz. per bushel) 0·18; formalin (1 to 480) 0·15; formalin (1 to 320) 0.00. Autumn sown in 1924 and in 1925, two experiments in each year, respectively: untreated 39·5, 35·09; 40·8, and 41·4 per cent.; dehydrated copper sulphate (one experiment in each year) 1·73 and 2·3; copper carbonate A (two experiments in 1924, one in 1925) 3·3, 1·14, and 1·05; copper dust B (49·93 per cent. copper) 2·1 (1925); formalin (1 to 480) 2·07 (1924) and 11·4 (1925); formalin (1 to 320) 6·3 and 2·04 (both 1924); uspulun 2·0 and 1·70 (1924); and germisan 5·0 and 1·59 (1924).

The control of bunt was accompanied by an increase in grain yield, amounting in three cases to over 100 per cent. In regard to the influence of *Tilletia tritici* on the germination of the seed and on general development, the results of the tests seem to indicate that the fungus has an adverse effect on the plant over and above that manifested by the replacement of healthy by bunted ears [see this *Review*, v p. 352]. As no bunt-free samples of grain were included in these trials, however, it has not been possible to discriminate absolutely between the effect of the fungus and any possible stimulating effect on the plant of the chemicals employed.

BODNÁR (J.) & TERÉNYI (A.). **Beiträge zur Biochemie der Wirkung von Quecksilberverbindungen auf die Steinbrandsporen des Weizens. (Vorläufige Mitteilung.)** [Contributions to the biochemistry of the action of mercury compounds on the spores of bunt of Wheat. (Preliminary note.)]—*Chem. Zeit.*, l, 19, pp. 109–110, 1926.

In a study of the fungicidal action of germisan, higosan, uspulun, tillantin C, and other mercurial preparations, a preliminaryinvestigation was made of the adsorption of mercury by the spores of bunt of wheat (*Tilletia tritici* and *T. levis*) during 15 minutes' immersion in 0·10, 0·05, or 0·01 per cent. solutions of each of four simple mercury compounds, namely, $HgCl_2$, $HgBr_2$, $Hg(CN)_2$, and $Hg(C_2H_3O_2)_2$. The largest quantity of mercury was adsorbed from the mercuric acetate (10·15, 9·07, and 3·50 per cent., respectively, for the three concentrations). The amounts adsorbed from mercuric chloride and mercuric bromide were very much smaller (3·65, 3·15, and 2.69 per cent. from the former and 2·58, 2·49, and 2·04 per cent. from the latter), while not a trace of mercury was adsorbed from the cyanide.

In germination tests in a 0·1 per cent. calcium nitrate solution, the spores treated with $HgCl_2$, $HgBr_2$, and $Hg(C_2H_3O_2)_2$ failed to germinate after 20 days, whilst those treated with $Hg(CN)_2$ germinated on the fourth day. It was further observed that spores treated with a 0·1 per cent. solution of oxycyanide of mercury germinated normally although they had adsorbed 2·12 per cent. of the metal.

In a test on soil the spores treated with $HgCl_2$ and $HgBr_2$ failed to germinate, while those treated with $Hg(C_2H_3O_2)_2$ germinated on the tenth, eighth, or third day, according to the concentration used. Thus $Hg(C_2H_3O_2)_2$ behaves like the copper compounds, merely retarding and not inhibiting germination.

The destructive action of $HgCl_2$ and $HgBr_2$ and the retardation of germination by $Hg(C_2H_3O_2)_2$ are explained as follows. In the aqueous solutions of $HgCl_2$ and $HgBr_2$ mercury occurs largely in the form of mercuric chloride and mercuric bromide, which, as lipoid compounds, penetrate the spore walls and come into contact with the protoplasm, causing the death of the spores. $Hg(C_2H_3O_2)_2$ dissociates much more completely than $HgCl_2$ and $HgBr_2$, and the Hg-ions adsorbed by the spores fail to penetrate the walls and are leached out by the soil moisture. $Hg(CN)_2$ does not combine with lipoids and does not dissociate at all.

It was found that the minimum quantity of mercury necessary to inhibit germination in a 10 c.c. $Ca(NO_3)_2$ solution was as follows: $Hg(CN)_2$, 0·79 mg.; $Hg(C_2H_3O_2)_2$, 0·32 mg.; $HgCl_2$, 0·22 mg.; and $HgBr_2$, 0·11 mg. Thus at the best a larger quantity of mercury (0·0011 per cent.) than copper (0·00075 per cent.) is required [see this *Review*, v, p. 154].

THOMAS (R. C.). **Control of smuts of Wheat and Oats with special reference to dust treatments.**—*Ohio Agric. Exper. Stat. Bull.* 390, pp. 405–423, 8 figs., 1925. [Received April, 1926.]

The symptoms and etiology of the smuts of wheat and oats are briefly described, together with the results of recent experiments in their control by dusting and other methods [see also this *Review*, v, p. 221] under Ohio conditions. Tables are also given showing the estimated losses from these diseases during 1918 to 1923.

Wheat bunt [*Tilletia levis*] (the estimated loss from which in 1923 was 50,000 bushels) was adequately controlled in 1924–1925 by copper carbonate (2 or 3 oz. per bushel), powdered copper sulphate (2 or 3 oz.), nickel silicate (2 oz.), copper stearate (0·5, 1, or 2 oz.), nickel acetate (2 oz.), basic nickel carbonate (3 oz.), dry Bordeaux mixture containing 11 per cent. copper (3 oz.), copper acetate (2 or 3 oz.), Du Pont dust Nos. 12 and 16 (2 oz.), and anhydrous nickel chloride (2 or 3 oz.). All these treatments reduced the incidence of infection from 29 to less than 1 (generally less than 0·5) per cent. Corona copper carbonate and acid nickel carbonate (2 oz.) reduced infection to 1·5 and 1 per cent., respectively.

Loose smut of wheat [*Ustilago tritici*], which caused an estimated loss of over 1,000,000 bushels in 1922, is best controlled by one to two minutes' immersion of the seed grain in water heated to 120° F., preceded by four to six hours' soaking in water at room temperature, and followed by ten minutes' immersion in water at 129°.

The estimated loss in Ohio from the loose and covered smuts of oats (*U. avenae* and *U. levis*) in 1918 was over 6,000,000 bushels. The best control of these diseases in 1925 was given by sprinkling with formaldehyde and the application of the same preparation in the so-called 'dry form', i.e., 1 part formaldehyde and 1 part water, using 1 qt. per 50 bushels, which reduced the incidence of infection

from 25 to 0·6 and 0·5 per cent., respectively. Very good results were also given by a mixture of copper acetate (1 part) and mercuric chloride (2 parts), at the rate of 3 oz. per bushel, and by anhydrous nickel chloride (3 oz.), which reduced the amount of smut to 1 and 2 per cent., respectively. Nearly all the treatments [the results of which are presented in tabular form] increased the yield, similar data having also been obtained in 1924 from the combination of copper and nickel compounds with mercuric chloride. The addition of a kaolin filler to the copper and mercury mixtures greatly reduced their fungicidal effect. In a field test the incidence of smut was reduced from 18 to 0·2 per cent. by 1 part copper acetate and 2 parts mercuric chloride; to 0·3 per cent. by 1 part copper sulphate and 2 parts mercuric chloride; and to 2 per cent. by 1 part copper carbonate and 2 parts mercuric chloride, all applied at the rate of 3 oz. per bushel [see this *Review*, iv, p. 528].

Brief directions are given for the application of the various methods of control, with notes on the use of formaldehyde and copper sulphate, and a short comparison between dusting and steeping. The cost of copper carbonate is stated to be 1 to 2 cents higher per bushel than that of formaldehyde, and the price of the copper-mercury compounds 10 to 13 cents higher.

CONNERS (I. L.). **Organic mercury compounds for the control of loose smuts of Wheat and Barley and Barley stripe.**—Abs. in *Phytopath.*, xvi, 1, pp. 63–64, 1926.

Stripe (*Helminthosporium gramineum*) in Minsturdi barley was practically controlled by one hour's immersion in 0·25 per cent. uspulun or germisan, or 0·3 per cent. semesan at room temperature. Germisan appeared to be the most efficacious. The control plots showed 8 per cent. infection. The modified hot water treatment was ineffectual (3·5 per cent. infection). Partial control of loose smut [*Ustilago nuda*] of Junior (hull-less) barley was obtained by the above solutions of organic mercury compounds at 45° C. (but not at room temperature), pre-soaking for one hour increasing the efficacy of the treatment. Some degree of control was also obtained by similar methods in the case of loose smut (*U. tritici*) of Kota wheat. Germisan was again the most effective but impaired the germination of the seed. The modified hot water treatment eliminated the smuts. The control plots showed over 20 per cent. of infection in the wheat and nearly 10 per cent. in the barley.

GAUDINEAU (Mlle) & GUYOT (L.). **De quelques facteurs qui influencent le développement de la maladie du piétin du Blé.** [On certain factors which influence the development of foot rot of Wheat.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 4, pp. 317–342, 4 pl., 1 fig., 1925. [Received April, 1926.]

The exceptionally mild and wet weather of 1925 in France proved favourable to the development of foot rot of wheat (*Ophiobolus graminis* and *Leptosphaeria herpotrichoides*) [see this *Review*, iv, p. 346]. Early sown winter wheat was observed to be the most susceptible to attack (86 per cent. for wheat sown on 7th October, against 54 on 1st November and 36 on 1st December), although the

spring wheats were not altogether immune (5 to 10 per cent.). The first signs of attack were evident four months after the autumn sowings and two months after those in the spring. The mycelium starts to penetrate the leaf sheaths at the base of the stem soon after the seedling appears, but then ceases to grow during the winter months, and renews activity only about the middle of April, when it passes from the sheaths to the stem tissues. Infection of the leaf sheaths may be deferred until the warm weather of spring or may take place, in mild winters, at any time between autumn and spring.

The earliest varieties are the most readily attacked, while the late or semi-late, such as Wilhelmina, Goldendrop, Hybride de la Paix, and Teverson show more resistance. Hybride de la Paix is particularly resistant to foot rot, though very susceptible to *Puccinia graminis*.

The disinfection of the soil with lime, sulphur, or sulphate of iron appears to have had no influence on the development of the disease in the authors' experiments. Fertilizers also seem to have had no certain effects. The destruction of weeds in the spring by spraying with copper sulphate or sulphate of iron did not appear to modify the intensity of the attack. On the other hand, the effect of sulphuric acid was, although irregular, often encouraging [see this *Review*, iv, p. 214]. Wheat sown in the autumn showed an average infection of 81 per cent. on the control plots, as compared with 37 per cent. in the plots treated with H_2SO_4. The application should be made before the mycelium passes from the sheaths to the stem, and experiments have shown that the best period is the first half of April. Solutions of 15 per cent. gave better results than 12, and much better than those of 10 per cent., and were most successful on wheat sown early in the autumn. These data apply to the region near Bussy, to the west of Amiens, where the authors' experiments were made.

FOËX (E.). **Traitement du piétin du Blé.** [Control of foot rot of Wheat.]—*Prog. Agric. et Vitic.*, lxxxv, 7, pp. 154–155, 1926.

The present note is written in the form of an open letter, calling, on behalf of the Institut des Recherches Agronomiques [France], for collaboration in research work on cereal foot rot (*Ophiobolus graminis* and *Leptosphaeria herpotrichoides*) which appears to have gained ground in France of recent years, especially on wheat. The statement is made that marked results in the control of the disease have been obtained from spraying the fields in the spring with dilute sulphuric acid [see preceding abstract]. As the chief factor determining the efficacy of this treatment appears to be the date of the application, an appeal is made to other institutions to help in further investigations by applying sulphuric acid at intervals of 10 days on a series of experimental plots, from January to March in the south, February to end of March in the latitude of Paris, and February to the beginning of April farther north. At the same time, other variables might be usefully studied, such as different concentrations of the quantity of acid used per hectare, the effect of additions of sodium nitrate or ammonium sulphate, the date of sowing, the variety of seed used, physical and chemical properties

of the soil, and the like. The experimental plots should be established in fields with homogeneous soil, preferably those which bore a cereal crop the previous year, and it should be borne in mind that soils that remain moist for a long time during the winter appear to be most liable to outbreaks of foot rot.

De Haan (K.). **Onderzoek over de strepenziekte van de Gerst en de verwekker Helminthosporium gramineum Rab.** [Investigation on the stripe disease of Barley and the causal organism *Helminthosporium gramineum* Rab.]—*Tijdschr. over Plantenziekten*, xxxii, 2, pp. 45–56, 1926. [English summary.]

The writer undertook an investigation of stripe disease of barley and its causal organism, *Helminthosporium gramineum*, with a view to elucidating the confusion stated to exist in phytopathological literature between this disease and two others, namely, leaf spot (*H. teres*) and foot rot (*H. sativum*).

Conflicting results have been obtained by previous investigators [whose work is cited and briefly summarized] as to the behaviour of *H. gramineum* in nature and in pure culture. For instance, Kölpin Ravn found no perithecial stage, and observed only sclerotia in pure culture; Diedicke, Noack, and Vogt recorded the occurrence of both sclerotia and perithecia in nature, only the sclerotial stage being observed in culture.

The writer's experiments, carried out from 1923 to 1925, are described. Sclerotia were found in nature on dead barley plants, and they also developed on almost completely desiccated lupin stalks or roll cultures of oatmeal agar. These sclerotia never developed into ripe perithecia, and their formation was inhibited by repeated exposure to temperatures below zero. The identity of the sclerotia found in nature was established by artificial inoculation on germinating barley seed with the mycelium developing from them.

It has been stated [see this *Review*, ii, p. 53] that the perithecia (of *Pleospora trichostoma*) develop on barley from an infected field after three days' incubation in a moist chamber. The writer has repeated this experiment with infected barley of varying origin, with uniformly negative results.

Kölpin Ravn and Vogt [see this *Review*, iii, p. 25] found no conidia in pure culture; Drechsler [see this *Review*, iii, p. 65] observed a very small number; while Diedicke and Noack reported their occurrence in profusion. The writer failed to observe conidia on the usual media, but they occurred in a completely desiccated roll culture of water agar which was kept in the dark at room temperature for a year.

The removal of the inferior palea from Mansholt's winter barley seed grain enabled the writer to secure over 24 per cent. infection by means of inoculation with the mycelium from a 14-day-old oatmeal culture. The Fletumer variety, on the other hand, proved highly resistant to this mode of infection. These results agree with those of field observations. It is claimed that by this method the degree of resistance can be determined in one year, instead of two as formerly required.

DAVIES (D. W.) & JONES (E. T.). **Studies in the inheritance of resistance and susceptibility to crown rust (P. coronata Corda) in a cross between selections of Red Rustproof (A. sterilis L.) and Scotch Potato (A. sativa L.).**—*Welsh Journ. of Agric.*, ii, pp. 212–221, 4 pl., 1926.

This paper records the results of investigations on the inheritance of resistance and susceptibility to crown rust (*Puccinia coronata*) [*P. lolii*] in a cross between resistant selections of Red Rustproof oats (*Avena sterilis*) and the highly susceptible Scotch Potato variety (*A. sativa*), carried out at the Welsh Plant Breeding Station, Aberystwyth, in 1923–1925. The strain of *P. lolii* used was collected from a leaf of the Scotch Potato variety, bearing only a few pustules.

The F_1 hybrid plants were inoculated *in situ*, while seedlings of both parents and of the F_2 generation of one F_1 hybrid were inoculated and studied under greenhouse conditions.

Of the 75 seedlings of the Red Rustproof parent inoculated, all were uniformly resistant, and of 60 seedlings of the Scotch Potato parent, all were equally susceptible. The F_1 hybrids showed a high degree of resistance. In the F_2 generation, quite apart from any possible effect of low temperature in relation to resistance, two definite types of reaction were apparent, namely, plants (resistant) which were heavily flecked, with or without the development of weak uredosori, and those (susceptible) which developed normal uredosori. Out of 1,041 plants of this generation, 258 were classified as susceptible, and 777 as resistant. Of the latter, 660 showed characteristic fleckings without any pustules, and 117 developed weak uredosori.

In discussing the interpretation of the results, the authors conclude that resistance appears to be almost, but not quite, completely dominant in the F_1 generation, which undoubtedly showed a very slight weakening in resistance when the factor or factors for resistance were in the heterozygous condition. According to the data provided, however, this was not true of all the heterozygous genotypes, as shown by the occurrence in the F_2 generation of only 117 phenotypes of this description out of a possible 518, the number calculated and expected on a single factor basis of inheritance.

The grouping obtained under the circumstances of the present investigation suggests that the transmission of the characters, resistance and susceptibility, is unifactorial. Segregation appears to occur in the F_2 generation in the ratio of three resistant to one susceptible.

MAINS (E. B.). **Rye resistant to leaf rust, stem rust, and powdery mildew.**—*Journ. Agric. Res.*, xxxii, 3, pp. 201–221, 6 pl., 1926.

This is the full paper, an abstract from which has already been noted from another source [see this *Review*, iv, p. 410], describing the high resistance to *Puccinia dispersa*, *P. graminis secalis*, and *Erysiphe graminis secalis* shown by two rye selections from the Abruzzes variety, at Purdue University, Indiana, United States.

SCHAFFNIT (E.) & VOLK (A.). **Ueber die Roggenfusariose und ihre Bekämpfung durch die 'Trockenbeize'.** [The fusariose of Rye and its control by dusting.]—*Zeitschr. für Pflanzenkrankh.*, xxxvi, 1–2, pp. 42–52, 1926.

The results of a series of experiments [the technique of which is fully described] in the control of *Fusarium nivale* [*Calonectria graminicola*] on rye by means of various dusts showed that the dry method is fully equal to the liquid treatment in efficacy. Particularly good results were given by Sch 614 (Höchster Farbwerke) and preparation No. 225 (Saccharinfabrik, Magdeburg), which reduced infection from 19·25 per cent. to nil, increased germination, and augmented the grain yield from 28·60 doppelzentner [1 doppelzentner = nearly 2 cwt.] per hect. to 33·69 and 33·16 doppelzentner, respectively. Sch 614 is applied at the rate of 300 gm. per doppelzentner of seed grain and No. 225 at that of 400 gm.

Uspulun dust (400 gm. per doppelzentner), Merck Saatbeize mit Hg (1,000 gm. per dz.), and Trockenbeize P. 257 (Gold- u. Silberscheideanstalt) at the rate of 300 gm. per doppelzentner, gave more or less unsatisfactory results in the laboratory (probably on account of their low degree of solubility), but in the field they were fully as effective as the other preparations.

All the writers' experiments in the control of bunt of wheat [*Tilletia tritici* and *T. levis*] by dusts have given unsatisfactory results with the winter varieties, while in the summer crops infection was partially or totally eliminated.

A brief account is given of the distribution of *C. graminicola* in Germany. The methods of rye seed testing for *F. nivale* practised at the Bonn-Poppelsdorf Agricultural College are described, and the general technique of dusting is briefly outlined.

SMITH (M. A.). **Infection and spore germination studies with Puccinia sorghi.**—Abs. in *Phytopath.*, xvi, 1, p. 69, 1926.

Oxalis corniculata was found heavily infected with the aecidial stage of *Puccinia sorghi* [*P. maydis*] throughout Iowa in 1925, the earliest infection being observed on 28th April and the latest on 19th June. Normal aecidial infection was obtained with teleutospores from maize on *O. corniculata*, *O. europaea*, and *O. tropaeoloides*, but only the pycnidial stage occurred on *O. valdiviensis* and *O. cernua*, while *O. rubra* remained immune. In a series of relative humidity trials at a uniform temperature of 25° C., 54 per cent. of the uredospores germinated at 100 per cent. humidity, 46 per cent. at 99·5, 36 per cent. at 99·1, 25 per cent. at 98·7, 11 per cent. at 98·2, and 3 per cent. at 97·5. Of the uredospores kept in the open from September onwards, 90 to 100 per cent. germinated of those tested during September and October; 65 per cent. in November; 12·5 per cent. in December; 4·2 per cent. in January; 3 to 4 per cent. in February; and only very few in March.

WESTON (W. H.) & WEBER (G. F.). **Downy mildew (Sclerospora graminicola (Sacc.) Schroet.) on the Everglade Millet (Chaetochloa magna (Griseb.) Scribn.).**—Abs. in *Phytopath.*, xvi, 1, p. 71, 1926.

Downy mildew of Everglade Millet (*Chaetochloa magna*) [*Setaria*

magna Griseb.] is apparently caused by *Sclerospora graminicola*, which has been found (for the first time on this host and in the southern States) on wild plants in south-eastern Florida. The fungus usually produces systemic infection, but occasionally the disease is localized in limited areas on the leaves. In the later stages large numbers of oogonia develop in the mesophyll tissue of the mature leaves, which disintegrate into fibrous tangles; and in the inflorescences, which become distorted and deformed. The fungus agrees with that found on *Chaetochloa* [*Setaria*] *viridis* in the northern States.

PELTIER (G. L.) & FREDERICH (W. J.). **Effects of weather on the world distribution and prevalence of Citrus canker and Citrus scab.**—*Journ. Agric. Res.*, xxxii, 2, pp. 147–164, 1 map, 8 graphs, 1926.

Based on a study of the behaviour of citrus scab (*Cladosporium* [*Sporotrichum*] *citri*) and canker (*Pseudomonas citri*) under natural and controlled conditions in Alabama [see this *Review*, iv, pp. 412, 413, 476], an attempt is made in this paper to correlate, in a general way, the effects of weather on the world distribution of these two diseases.

Considering the temperature factor alone, scab would be inhibited in such regions as the Philippines, where high mean temperatures (75° F. or above) prevail throughout the year. In most regions the period of activity of the disease would be limited to the spring season. In Japan, owing to the lower monthly mean temperatures, the period of scab activity extends into July. In California the prevailing temperatures are suitable for the development of scab, but the absence of rain during spring growth is an inhibiting factor.

Canker could develop in all the citrus-growing regions of the world at some period during the growing season, most severely in places having the greatest number of months with mean temperatures of 80° or above. Temperature is in no case a limiting factor in the development of canker, as it is in that of scab, in any of the citrus regions.

Considering the moisture factor by itself, scab is serious only in regions having an annual rainfall of at least 50 inches, fairly evenly distributed over the year. It has, moreover, never been reported from any country in which a well-defined dry season occurs, especially when high temperatures prevail at the same time. Apparently a dry season is a more important factor in scab inhibition than a deficiency of precipitation during the spring months, though the latter is a limiting factor in the development of canker.

Considering the combinations of environmental factors, conditions essential for the development of canker are present wherever the temperature and precipitation curves during the growing period are ascending and rounding (i. e., not in a sharp peak), as in the Gulf Coast States of North America, China, and South Africa, since such conditions stimulate the rapid growth of the hosts and thus render them more susceptible, while the optimal conditions for infection are prolonged. On the other hand, no canker has been found in those localities where the precipitation curves are descending. In California, with the highest monthly mean temperatures,

the amount of precipitation is lowest. The seasonal distribution of the rainfall appears to be a more important factor in the limitation of both diseases than its amount or frequency.

PELTIER (G. L.) & FREDERICH (W. J.). **Further studies on the overwintering of Pseudomonas citri.**—*Journ. Agric. Res.*, xxxii, 4, pp. 335–345, 3 pl., 1926.

Observations made in southern Alabama from 1917 to 1921, a period during which the winter seasons varied greatly in severity, indicate that, under local conditions, *Pseudomonas citri*, the cause of citrus canker [see this *Review*, iv, p. 476] cannot overwinter either in the soil or on the fallen leaves [but see this *Review*, iv, p. 529]. It is carried over the winter in old spots on the leaves that remain on the trees, in spots or cankers formed on twigs towards the end of the growing season, principally on angular wood, and also by means of an extended or arrested incubation period in the leaves and twigs of the last growth of the season. The latter method of overwintering only occurs in seasons when frosts are long delayed. That the organism is able to spread internally to some extent during the dormant season is shown by the fact that in the spring the infection appears to extend over a larger part of the leaves, new spots appearing around the margins of the old ones. The organism was not recovered from any of the cankers one year old or older, and the assumption appears safe that the viability of an individual canker spot is more or less limited. The number of viable spots which survive the winter is influenced by the severity of the latter, as very cold periods cause almost complete shedding of the infected leaves, and kill back the angular wood.

BARTHOLOMEW (E. T.). **Internal decline of Lemons. III. Water deficit in Lemon fruits caused by excessive evaporation.**—*Amer. Journ. of Botany*, xiii, 2, pp. 102–117, 2 figs., 9 graphs, 1926.

The writer has continued his previous studies on internal decline or endoxerosis of lemon fruits [see this *Review*, ii, p. 406].

Because of the importance of the withdrawal of water from the fruit, a special auxograph was devised for the investigation of this factor. The instrument consists of a partially dismantled thermograph to which a few simple attachments are added. Changes in the diameter of a lemon (still attached to its branch) were transmitted to the pen by the use of two levers, the auxographs being so calibrated that a given distance of movement of the pen on the chart could be translated into terms of expansion or shrinkage of the fruit. The temperature range during the experiments was 41° to 45° F.

The records of the auxograph [which are fully discussed as well as being presented in the form of graphs] showed that the lemon fruit is very sensitive to changes in the water content of the leaves, as affected by the amount of moisture in the soil and by climatic conditions. The fruits may even begin to suffer long before the foliage shows signs of wilting. The drier the soil becomes, the greater is the amount of water withdrawn from the lemon and the longer its period of water deficit.

While these tests have shown that the amount of water available for

the fruit is influenced by the amount of available soil moisture, they have also demonstrated the inability of the root system of a lemon tree, grown under arid or semi-arid conditions, fully to supply the water demands resultant upon rapid evaporation, irrespective of the amount of soil moisture.

The records show that during periods of excessive evaporation the water deficit may continue, day and night, for at least three or four weeks at a time. It would seem evident that the size, texture, flavour, keeping quality, and other characteristics of the fruit must be profoundly modified by such a condition.

BENTON (R. J.). **Borax treatment of Lemons for store.**—*Agric. Gaz. New South Wales*, xxxvii, 2, p. 94, 1926.

Dipping lemons in a 5 per cent. solution of borax at 115° F. for five minutes has given satisfactory results in improving their keeping qualities in storage at ordinary temperature at Wyong, New South Wales, the dipped fruit (2 bushels) being practically free from blue mould after five days, compared with 8 to 15 infected in each of six untreated cases. A month later the treated fruit was still in excellent condition.

CAVARA (F.). **Mauginiella scaettae Cav., nuovo Ifomicete parassita della Palma da Datteri in Cirenaica.** [*Mauginiella scaettae* Cav., a new hyphomycetous parasite of the Date Palm in Cyrenaica.]—*Bull. Orto Bot. Napoli*, viii, pp. 207–211, 1 pl., 1925. [Abs. in *Riv. Patol. Veg.*, xvi, 1–2, pp. 23–24, 1926.]

The author gives a more detailed, illustrated, description of the fungus *Mauginiella scaettae*, which he considers to be responsible for atrophy of the inflorescence of a date palm [*Phoenix dactylifera*] received from Cyrenaica, than that previously noticed [see this *Review*, iv, p. 477].

AVERNA-SACCÁ (R.). **As manifestações pathologicas que acompanham o desenvolvimento da broca Stephanoderes hampei Ferr. (= St. coffeae Hag.) nos fructos ou nas sementes do Cafeeiro.** [The pathological manifestations which accompany the development of the borer *Stephanoderes hampei* Ferr. (= *St. coffeae* Hag.) on the berries or seeds of Coffee.]—*Comm. Estud. e Debellação da Praga Caffeira (Secret. da Agric., Comm. e Obras Publ., São Paulo)*, Publ. N. 15, 87 pp., 11 pl., 29 figs. (6 col.), 1926.

The fungous diseases associated with the attacks of the berry borer (*Stephanoderes hampei*) [see this *Review*, iii, p. 516] on coffee berries or seeds may be divided into two groups, namely, constant or quasi-constant, and occasional. To the first belong *Nectria coffeigena* and *Fusarium rimicolum* (both associated with the condition known as 'café chocho') [see this *Review*, v, p. 160], *Verticillium albo-atrum*, and *Gloeosporium coffeigenum* n. sp., the last-named being characterized by a hyaline, branched, septate mycelium and ellipsoid, cylindrical, or ovate-elliptical, straight or slightly curved, hyaline to pale yellow conidia, measuring 10 to 21 by 5·4 to 8 μ.

The fungi occasionally accompanying the attacks of *S. hampei*

and *N. coffeigena* include, amongst others, *Dothidea neivae* n. sp.; *Pionnotes navarrae* n. sp.; *Stachylidium coffeicola*; *Cerebella* sp.; *Ramularia goeldiana* (Sacc.) Averna-Saccá; and *Aegerita duthiei* (the 'ambrosia fungus'), the systematic position of which is discussed. Diagnoses of the new species are given.

TUCKER (C. M.). **A leaf, bract, and boll spot of sea-island Cotton caused by Helminthosporium gossypii n. sp.**—*Journ. Agric. Res.*, xxxii, 4, pp. 391–395, 2 figs., 1926.

Sea-island cotton (*Gossypium barbadense*), the only variety grown on a commercial scale in Porto Rico, has been attacked since 1923, in all parts of the island where it is cultivated, by a disease showing the following symptoms. On the leaves and bracts appear numerous circular (frequently confluent), at first light red, later dark purple spots, from 1 to 8 mm. in diameter. These eventually become brown or ashen in the centre, where the tissues often fall out, leaving jagged holes in the leaves. On the bolls, which are only infected when young, the lesions are punctate and purplish and do not appear to penetrate to the lint and seed.

Isolations showed the constant presence in the diseased tissues of a *Helminthosporium* with amphigenous, brown, straight cylindrical to nodose or bent and geniculate, continuous to 5-septate conidiophores, measuring 40 to 185 by 6·5 to 8·5 μ and arising from the stomata or from between the epidermal cells, either singly or in groups of three to six. The conidia are light to dark fuliginous, thick walled, elliptical, typically somewhat curved but occasionally straight, rounded at the ends, with an inconspicuous hilum, 1- to 8- (mostly 4- to 7-) septate, and 35 to 118 by 11·7 to 18·5 μ (average 87 by 15·3 μ). The conidia usually germinate by one to three polar and one central germ-tube. Since the organism differs markedly both in nature and in pure culture [details of which are given] from the species of this genus previously recorded from Porto Rico and no similar fungus appears to have been recorded on cotton or allied plants, it is described as a new species under the name of *Helminthosporium gossypii*, an English diagnosis of which is given.

Inoculation experiments with pure cultures in every case reproduced the disease in all its symptoms. The fungus is not seed borne and plants raised from seed collected from infected bolls remained healthy. The most important source of infection is considered to be the infected plants that remain in the fields, and if the closed season for cotton growing now advocated for the control of the pink bollworm is practised, it is believed that the incidence of the disease will decrease. It was also observed that the disease was more severe in periods of drought than under humid conditions.

MASON (T. G.) & WRIGHT (C. H.). **A survey of factors affecting the development of the Cotton plant in the Oyo and Abeokuta provinces of Southern Nigeria.**—*Fourth Ann. Bull. Agric. Dept. Nigeria*, pp. 3–31, 3 graphs, 1925. [Received April, 1926.]

Amongst the factors affecting the development of the cotton plant in Southern Nigeria [see this *Review*, iv, p. 217] various diseases

play a part. American cotton affected by leaf roll shows a dulness of the foliage, the edges of the lamina being rolled downwards and the under surface presenting a glazed appearance upon which the veins are sharply delimited; fenestration may be observed in severe cases. In native varieties the leaves are crimped round the margin and the downward roll is seldom seen. The disease is apparently not infectious and is presumed to be of physiological origin, associated with excessive soil moisture and, probably, absence of shade. American varieties suffer more severely and frequently than native ones, though the latter shed their buds to a marked extent when affected.

An investigation of the relative importance of physiological shedding (which is considered to be resultant of two opposing factors, namely, the rate at which food is synthesized by the plant and the rate at which it is utilized in the maturation of the fruits) and shedding caused by the depredations of insects and fungi was carried out.

Damage sustained in the later phases of boll development resulted in heavy losses in the crop of both types of cotton. The injury from internal boll disease [*Nematospora gossypii*: see above, p. 389, and next abstract] was much more severe in American than in native cotton, the latter probably being protected to some extent by its later fruiting. The yield of native cotton, however, was heavily reduced by anthracnose (*Glomerella gossypii*), associated with a species of *Fusarium*. The data [presented in tabular form] obtained on the incidence of these diseases in experimental plots indicate that both anthracnose and the internal boll disease diminished during the dry weather but increased again with the advent of the rains. In American varieties the staining of the lint by the cotton stainers, *Dysdercus superstitiosus*, *D. melanoderes*, and *D. fasciatus*, was closely associated with internal boll disease; while anthracnose was probably a more important factor in the staining of the lint of native varieties.

LAYCOCK (T.). **Preliminary investigations of the parasitism of certain fungi causing boll rots of Cotton.**—*Fourth Ann. Bull. Agric. Dept. Nigeria*, pp. 32–49, 1925. [Received April, 1926.]

Internal boll disease [see preceding abstract] in Nigeria is associated with Nowell's undetermined species C [*Nematospora gossypii*: see above, p. 389] which was isolated by the writer in Southern Nigeria in 1923. The dependence of the disease on punctures by cotton stainer bugs (*Dysdercus superstitiosus* and other species) has been repeatedly demonstrated both in the West Indies and Nigeria. In one test thirty bolls were screened from the flower stage onwards and, at 16 days old, cage-bred stainers were introduced to ten, field stainers to ten, and ten served as controls. The results were not conclusive owing to injury caused by a heavy rainfall, but internal boll disease was present in all three series, the largest number of wholly damaged locks occurring in those visited by the field stainers. In another test, in which the bolls were not disinfected and the investigation was deferred until they were fully open, internal boll disease was entirely absent from those attacked by the cage-bred stainers, and present in ten out of twelve visited by field stainers.

No infection resulted from smearing a pure culture of the fungus on the boll, but positive results were obtained in a few cases by smearing with the fungus after wounding. Infection was confined to young punctured bolls and was readily obtained by introducing cage-bred stainers to bolls smeared with the fungus.

A marked peculiarity of internal boll disease is the complete absence of external symptoms, even in the case of total internal decay.

No alternative hosts of the fungus have been discovered in Nigeria.

Anthracnose (*Glomerella gossypii*) is one of the chief causes of the mummification and distortion of bolls. Dark brown or black, depressed lesions appear on the boll wall, and the fungus produces a dark pink, compact stroma on the affected part, often accompanied by zonation. A species of *Fusarium* frequently associated with *G. gossypii* [see preceding abstract] produces a very similar, but somewhat lighter and less compact stroma, and therefore the damage due to these two organisms is sometimes confused. Anthracnose is, however, the more virulent factor in the causation of injury to the bolls, producing 60 per cent. of severe damage in one comparative examination, compared with 24 per cent. by *Fusarium*.

A detailed analysis of the damage caused by *G. gossypii* on mummified bolls showed percentages ranging from 22·5 to 36·9, the latter occurring on the Meko variety. The highest damage from *Pseudomonas* [*Bacterium*] *malvacearum* was 7·8 and that from *Alternaria* sp. 3·9 per cent.

The above-mentioned species of *Fusarium*, in addition to its association with *G. gossypii*, frequently occurs on lesions produced on the stem and leaves by *Bact. malvacearum*. Inoculation experiments were conducted to determine the possible identity of this fungus with *F. vasinfectum* [see this *Review*, v, p. 30], the results of which clearly indicate that it is at most a wound parasite. Two seasons' observations indicate that it is more generally distributed than anthracnose, but less virulent.

Shapovalov (M.). **Aspergillus decay of Cotton bolls.**—Abs. in *Phytopath.*, xvi, 1, p. 75, 1926.

During the past few years a decay of cotton bolls, beginning as a soft, pinkish rot, and finally causing the desiccation of the boll, has been prevalent in the south-western States. Affected bolls become filled and covered on the outside with black masses of spores resembling those of smut—the name by which the disease is incorrectly known in California. The causal organism is *Aspergillus niger*, which is sometimes associated with insect injuries. Successful inoculations have been made, under field and laboratory conditions (76 and 100 per cent. infection, respectively), by the insertion of spores in scalpel stabs or needle pricks.

Young (V. H.). **Cotton wilt studies.**—Abs. in *Phytopath.*, xvi, 1, p. 76, 1926.

Isolations of *Fusarium vasinfectum* from several parts of the United States showed an appreciable difference in their pathogenicity for cotton, and appeared to be distinct strains. Inoculations with a monospore strain in the greenhouse in late summer,

and in soil temperature tanks at 30° C., gave 50 per cent. infection under the latter condition and none under the former. Experiments in the tanks at 22·5° to 35° resulted in no infection at 25°, some at 27·5°, and the highest incidence at 32·5°, while a trace was observed at 35°. A second experiment gave similar results.

FERRIS (E. B.). **Cotton experiments, 1925.**—*Mississippi Agric. Exper. Stat. Circ.* 63, 7 pp., 1925. [Received 1926.]

The following reference in this report is of phytopathological interest. Four out of 56 cotton plots used in fertilizer tests since 1919 having become infected by wilt [*Fusarium vasinfectum*], kainit (300 lb. per acre) was added to the usual fertilizer, consisting of acid phosphate and nitrate of soda (300 lb. per acre of each), on half the rows of each plot, to test its influence on the disease. Nearly all the cotton died on the parts without kainit, while on those receiving it a considerable number survived. The yield from the plots receiving kainit amounted to 828 lb. per acre, compared with 488 lb. from those not so treated.

KING (C. J.) & LOOMIS (H. F.). **Experiments on the control of Cotton root rot in Arizona.**—*Journ. Agric. Res.*, xxxii, 4, pp. 297–310, 2 pl., 6 figs., 1926.

Cotton root rot, *Phymatotrichum omnivorum* [see this *Review*, ii, p. 501, and above, p. 405], is stated to be the most serious disease affecting cotton, lucerne, fruit trees, and many other economic plants in the valleys of southern Arizona, where the annual losses caused by it are estimated at from one to five million dollars, besides the considerable depreciation of land values for which it is responsible by rendering extensive tracts of land unfit for cultivation with the most profitable crops. The methods of control recommended for Texas [see this *Review*, iii, p. 134] were found to be impracticable in Arizona owing to the fact that the local climatic conditions favour the continued development of the cotton plants late into the autumn, while experiments with deep spring ploughing showed but little or no benefit.

On the other hand, experiments conducted since 1920 at Sacaton, Arizona, to test the effect of applications of manure and other organic matter on the control of the disease, consistently showed that a reduction in the infected area and in the number of cotton plants dying from root rot resulted from the treatment. In a highly infected experimental plot of Pima Egyptian cotton, the diseased area was reduced from 71·7 per cent. in 1920 to 2·2 per cent. in 1924, after four years of manurial treatment. Out of the seven rows of cotton, 410 feet long, in this plot, the three inner rows were practically free from infection in 1923, and in 1924 two of them were entirely free. It was further noted that the incidence of the disease was delayed in the manured plots, thus allowing some of the infected plants to produce nearly a full crop.

An examination of the root system of cotton plants growing in a plot treated with organic matter for four years, and in the adjacent control plots, showed the former to be more superficial, with larger laterals and more fibrous roots near the surface of the ground. The fact that some of the plants in the manured plots,

although apparently healthy in their aerial parts, had infected and partially decayed roots, suggests that the application of manure does not, to any marked degree, affect the development of the pathogen, but that it helps the plants to avoid or withstand the disease.

PETCH (T.). **Studies in entomogenous fungi. VIII. Notes on Beauveria.**—*Trans. Brit. Mycol. Soc.*, x, 4, pp. 244–271, 1 fig., 1926.

After a full historical account of the genus *Beauveria* and a discussion of the morphology and classification of the species comprised in it, the author describes cultural experiments made by him with specimens of *Beauveria* collected in Ceylon on a Phalangid, a Locustid (*Aularches miliaris*), an undetermined Curculionid, a queen red ant (*Oecophylla smaragdina*), a red coco-nut weevil (*Rhynchophorus ferrugineus*), a Chrysomelid (*Metriona circumdata*), a *Mantis*, and an undetermined fly ; a specimen of *B. globulifera* on *Gargaphia* supplied by Spegazzini; specimens of *B. stephanoderis* on *Stephanoderes hampei* sent by Friederichs and Begemann [from the Dutch East Indies: see this *Review*, ii, p. 368]; and specimens of the *B. densa* type on a Halticid on *Vigna oligosperma* sent by Friederichs. Cultures of *B. bassiana* and *B. densa* from the National Collection of Type Cultures [London] were also used for comparison. Of the Ceylon forms, the first six agreed in their spore characters with *B. bassiana* or *B. globulifera*, and the two last forms with *B. densa*. In view of its spore and growth characters *B. stephanoderis* belongs, in the author's opinion, to the *B. bassiana* group [see also this *Review*, iii, p. 516].

The differences noted in the type of growth in culture and in the coloration of the different culture media [shown in tabular form] would lead to the conclusion, if these features are accepted as specific characters, that all the strains grown in this series of experiments are different species, and that each species of insect has its own particular species of *Beauveria* parasitic upon it. On the other hand, a review of the records of the host insects of the various species of *Beauveria* and the results of infection experiments by the author and other investigators undoubtedly point to the pleophagy of these fungi, and it does not appear probable that the parasitism of a given species of *Beauveria* is restricted to one species or even to one group of insects. The author, therefore, thinks it probable that the differences observed in the pigmentation of the culture media depend upon the kind of medium on which the fungus was previously grown, and that the same fungus, after having grown on different insects, may produce different colorations of the media.

The examples of *Beauveria* dealt with by the author, like the European forms, fall into two groups, namely, one with conidia chiefly globose, and another with conidia chiefly oval. From the recorded spore measurements, the forms with globose spores agree with *B. globulifera*, and not with *B. bassiana*, but an examination of European cultures of the latter indicated that this apparent difference is non-existent, the conidia of *B. bassiana* varying from

globose to broadly oval, and thus agreeing with those of *B. globulifera*. In view of the breakdown of the method of determining species of *Beauveria* by their behaviour in culture, it would appear preferable, until further evidence is available, to regard the Ceylon and Javan forms as possibly biologic forms of *B. bassiana* and *B. densa* rather than to describe them as new species.

VUILLEMIN (P.). **A new fungus disease of the satin moth larva.**—*Canadian Entom.*, lvii, 4, pp. 97–99, 7 figs., 1925. [In French.]

Diseased larvae and pupae of the satin moth (*Stilpnotia salicis*) from British Columbia were found to be infected by a new species of *Spicaria*, *S. canadensis* Vuillemin [a short Latin diagnosis of which is given]. The fungus grows well on a variety of media (carrot, mulberry leaves, &c.), at room temperature, in the refrigerator at 3° to 5°, or in the incubator at 30° to 37° C., the death-point being 45°. The catenulate, hyaline, oblong conidia, measuring 4 to 5·4 by 2·8 to 3 μ, are borne in basipetal succession on flask-shaped phialids, measuring 8 to 17 by 3 μ.

STORM VAN LEEUWEN (W.), BIEN (Z.), KREMER (W.), & VAREKAMP (H.). **Ueber die Bedeutung kleinsporiger Aspergillus-Arten (Typus Aspergillus fumigatus) für die Aetiologie des Asthma bronchiale.** [On the significance of small-spored species of *Aspergillus* (type *Aspergillus fumigatus*) for the etiology of asthma bronchiale.]—*Zeitschr. für Immunitätsforsch.*, xliv, 1, pp. 1–29, 2 figs., 1925.

No marked differences were found in the yeast and fungous spore content of the atmosphere in various districts of Holland which varied considerably as to the incidence of bronchial asthma among the population. *Aspergillus fumigatus* could not be detected either in the air, field soils, or private houses.

The yeasts, moulds, and species of *Monilia* regularly isolated from the sputum of asthmatic patients cannot be considered as causal organisms in the ordinary sense, though they may accentuate susceptibility to attack. This is stated to be particularly true of *A. fumigatus*. Eiderdown and other bedding materials were found frequently to contain allergic [anaphylactic] substances, the presence of which was uniformly associated with that of *A. fumigatus*. The so-called '*fumigatus* allergen' (extract of eiderdown inoculated with *A. fumigatus*) produced a positive reaction in 40 per cent. of asthmatic patients, while 46 normal subjects were unaffected. Young pigeons fed with infected maize seed also developed the typical symptoms of dyspnoea.

These investigations are regarded as supporting the view that certain diseases are produced by parasites developing their toxins outside the body and causing infection on contact with the skin or membranes of various individuals.

GAMMEL (J. A.), MISKDJIAN (H.), & THATCHER (H. S.). **Madura foot (mycetoma): the black grain variety in a native American.**—*Arch. of Dermatology*, xiii, 1, pp. 66–77, 6 figs., 1926.

Report is made of an infection with the granuloma maduro-

mycosis (mycetoma) in a Mexican from Texas, this being the eleventh record from that State and the twenty-first from the United States.

The infection was of the black grain variety—the first case of this type reported in a native American and the second from the North American continent.

Inoculation experiments on various animals gave negative results.

The outcome of preliminary cultural experiments suggests the inclusion of the causal fungus in Brumpt's *Madurella* group as a new species, *Madurella americana*, a detailed description of which will be published later.

ARNAUD (G. & Mme). **Un Entyloma parasite des Dahlias.** [An *Entyloma* parasitic on Dahlias.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 4, pp. 263–264, 1925. [Received April, 1926.]

A leaf spot of dahlias caused by a species of *Entyloma* was first noticed near Paris a few years ago, and is now fairly common. It causes round, yellowish-green spots on the leaves, or less often numerous, irregular, chequered patches. Later on the centre dries out and turns greyish-brown. Numerous resting spores of the parasite occur in the affected tissues. In October the lower leaves were observed to be chiefly attacked, the upper parts of the plant being healthy.

Whether the species concerned is *E. calendulae*, a common parasite of marigolds (*Calendula*), or, as the author thinks is more probable, some species of recent introduction to Europe, was not determined. Up to the present it has not caused serious damage in France. It was recorded in Belgium by Sternon in 1918.

CIFERRI (R.). **Sul potere patogenetico dei funghi causanti l' 'antracnosi' delle Orchidaceae.** [On the pathogenicity of fungi causing the anthracnose of Orchidaceae.]—*Riv. Patol. Veg.*, xvi, 1–2, pp. 1–16, 1 pl., 1926.

The author gives a list of no less than 36 species of *Gloeosporium* and *Colletotrichum* reported on orchids in association with anthracnose.

After a brief review of various somewhat contradictory investigations as to the cause of this disease, reference is made to the independent occurrence of both *Colletotrichum* (? *C. vanillae*) and *Gloeosporium* in the soft rot of vanilla (*Vanilla planifolia*) in Ceylon [see this *Review*, iii, p. 553] and also in Brazil. The author has studied three strains of *Gloeosporium* and two of *Colletotrichum* which were isolated from five different Orchidaceae, including vanilla. A series of inoculation tests was made with these strains on a large range of orchids and on vanilla and resulted in 281 failures to produce infection, 8 successes, and 11 doubtful. In a second series, however, in which the leaves were coated with collodion and castor oil, a high percentage of successes was obtained. It is concluded that the fungi concerned behave only as weak or secondary parasites. A species (? *G. affine*) isolated from *Hoya carnosa* was also shown to be able to infect orchids, causing the same symptoms as in the other cases.

DRECHSLER (C.). **Foot-rot of Lilium candidum and Lilium pyrenaicum caused by Phytophthora cactorum.**—*Phytopath.*, xvi, 1, pp. 51–53, 1926.

In May, 1925, the writer examined a diseased Madonna lily (*Lilium candidum*) from Tacoma Park, Maryland, the subterranean part of the stem of which was considerably shrunken, while the parenchyma external to the strands of conducting elements was completely collapsed. Both in this tissue and in the central pith there was a profusion of non-septate intercellular mycelium with diverticulate protuberances. A species of *Phytophthora* producing little aerial mycelium but an abundance of sporangia and oospores was isolated in pure culture from the diseased tissue.

Some weeks later a specimen of *L. pyrenaicum* from the same plot, apparently affected by an identical disease, was examined, and the same species of *Phytophthora* was isolated from the affected tissues.

The fungus was compared with, and found to be closely related to *P. cactorum* [see this *Review*, ii, p. 433]. The average diameter of the oospores of the fungus from *L. candidum* was 26·4 μ, and that of those from *L. pyrenaicum* 27·1 μ; the corresponding conidial dimensions were 35·7 by 27·3 and 34·9 by 27·9 μ, respectively. These figures are in substantial agreement with the averages obtained from comparable measurements of several strains of *P. cactorum* from rhubarb and apple [see this *Review*, ii, p. 433]. The lily fungus is therefore referred to *P. cactorum*.

The symptoms described appear to differ widely from those characteristic of stump rot of Easter lilies (*L. longiflorum*) in Bermuda [see this *Review*, iv, p. 480], attributed to an undetermined species of *Phytophthora*: they are perhaps more closely related to those produced by *P. cryptogea* on tomatoes.

DRAYTON (F. L.). **The dry rot disease of Gladioli.**—*Scient. Agric.*, vi, 6, pp. 199–209, 7 figs., 1926.

This is a detailed account of a disease of gladioli that is of considerable economic importance to flower growers in Canada, as it kills living plants in the field and causes a destructive dry rot of the corms in storage. A full description is given of the symptoms on the plants, and of the morphology and cultural features of the causal organism, which was tentatively placed by Massey (in a paper on the disease read by him in 1917 at the Pittsburg meeting of the American Phytopathological Society) in the genus *Sclerotium*. The author of the present paper is trying various methods for finding or inducing a spore stage which might lead to a more satisfactory classification of the fungus. The paper terminates by an outline of control measures against the disease.

KUNKEL (L. O.). **Incubation period of Aster yellows in its insect host.**—Abs. in *Phytopath.*, xvi, 1, p. 67, 1926.

Transmission experiments indicate that the virus of aster [*Callistephus chinensis*] yellows [see this *Review*, v, p. 81] passes through an incubation period of varying duration in its insect host, the leafhopper *Cicadula sexnotata* Fall. In the case of nymphs a fortnight or more must usually elapse before non-infective insects exposed

to a diseased plant are able to transmit yellows to healthy plants. The corresponding period for adult insects is six to ten days. Infective insects appear to retain permanently their capacity to transmit yellows.

Patel (M. K.). **Study of Peronospora trifoliorum De By. on species of Leguminosae.**—Abs. in *Phytopath.*, xvi, 1, p. 72, 1926.

The economic importance of the lucerne disease caused by *Peronospora trifoliorum* is stated to be increasing in the middle western States in proportion to the extended acreage under this crop. The fungus appears to be restricted to *Medicago sativa* and *M. lupulina*, 31 other species of 16 genera of Leguminosae having been exposed to infection with negative results. The disease, though generally localized, may become systemic, involving parts of the shoots by infection from the crown. The fungus survives adverse conditions by the sparse production of oospores in the late autumn. Conidia frozen in water retained their viability after 173 hours. The optimum temperature for conidial germination was 18°, minimum 4°, and maximum 29° C. No germination occurred on a dry slide in 100 per cent. atmospheric humidity.

Monteith (J.). **Colletotrichum trifolii and Gloeosporium caulivorum on Clover.**—Abs. in *Phytopath.*, xvi, 1, pp. 71–72, 1926.

The two common anthracnose diseases of clover caused by *Colletotrichum trifolii* [see this *Review*, iv, p. 598] and *Gloeosporium caulivorum* [see this *Review*, iv, p. 351], respectively, have been shown to be largely dependent on temperature. On potato dextrose agar the optimum temperature for growth of *C. trifolii* is about 28° C. and for that of *G. caulivorum* 20°, the corresponding minimum temperatures being 12° and 4°. At 32° *C. trifolii* grew rapidly but *G. caulivorum* made scarcely any growth. Sporulation was abundant in *C. trifolii* at 20° to 32°, but not at lower temperatures, whereas *G. caulivorum* produced spores by budding over its whole temperature range. Artificial inoculations under controlled conditions indicate that the temperature relations for infection are similar. The two fungi produce practically identical symptoms on clover, *C. trifolii* being most important in warm weather and in the south, while *G. caulivorum* is prevalent under cooler conditions and in the north. Certain imported strains of red clover are most susceptible, while some of the native American varieties are highly resistant to both organisms.

Murphy (P. A.). **Some fungus diseases of fruit trees.**—*Journ. Dept. Lands and Agric. Ireland*, xxv, 3, pp. 269–280, 2 pl., 1926.

A description is given of the symptoms [well illustrated] and control of each of the following diseases of fruit trees: apple scab (*Venturia inaequalis*); pear scab (*V. pirina*); apple canker (*Nectria galligena*); apple mildew (*Podosphaera leucotricha*); brown rot of apples (*Sclerotinia fructigena*); blossom wilt of apples and plums (*S. cinerea* f. *mali* and f. *pruni*, respectively); and silver leaf of plums and other fruit trees (*Stereum purpureum*). Notes are given in

some cases on the incidence of these diseases in Ireland and on the resistance and susceptibility of different varieties of fruit trees to them.

NICOLAS (G.). **Observations sur le plomb.** [Observations on silver leaf disease.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 4 pp. 265–269, 1925. [Received April, 1926.]

The author believes that silver leaf of fruit trees can be caused by non-parasitic agencies, resulting in organic and physiological disturbances, as well as by *Stereum purpureum*. He has observed old almond trees near Toulouse which were unmistakably affected by this disease but which bore no fructifications of *Stereum*, nor did they contain any mycelium in their tissues. The presence of *Heliothrips haemorrhoidalis* on leaves of *Viburnum tinus* in Algeria was also found to be associated with this condition, and healthy leaves on which these thrips fed became silvered in small spots.

In general he concludes that various agencies can produce an exaggerated secretion of an enzyme capable of hydrolizing the pectic substances of the outer epidermal wall, the silvery appearance of the leaf being attributed to this process [see also this *Review*, iii, p. 46].

NIXON (E. L.). **Migration and transformation of Bacillus amylovorus in Apple tissue.**—Abs. in *Phytopath.*, xvi, 1, p. 77, 1926.

The migration of *Bacillus amylovorus* in the form of zoogloeae was found in the early stages of infection occurring through intercellular spaces in the cortical regions of apple twigs. The walls of the phloem parenchyma and medullary ray cells are then penetrated, and in some cases the organism also penetrates the protoplast of healthy cells, forming a cyst within the central vacuole. In this condition hibernation takes place. With the renewed spring growth of the host the cysts imbibe moisture and disintegrate, the bacterial masses escaping from the cells in the form of the familiar exudate. Disintegration of the bacterial masses was observed in some regions, while in others involution and spore forms occurred.

ROBERTS (J. W.). **Apple scab.**—*U.S. Dept. of Agric. Farmers' Bull.* 1478, 12 pp., 8 figs., 1926.

A popular description is given of the symptoms and life-history of apple scab (*Venturia inaequalis*), together with notes on the relative susceptibility of different varieties and full directions for control by the application of lime-sulphur or Bordeaux mixture.

WALTON (R. C.) & ORTON (C. R.). **The perfect stage of Cylindrosporium pomi.**—*Science*, N.S., lxiii, 1626, p. 236, 1926.

Preliminary inoculation experiments with conidia characteristically like those of *Cylindrosporium* [*Phoma*] *pomi* Brooks [see this *Review*, iii, p. 43; v, p. 105] obtained in culture from perithecia found on overwintered apple leaves in Pennsylvania, in 1924, caused a typical spotting of Baldwin, Grimes Golden, and Stayman apples. In 1925 a more extensive series of experiments was

carried out on the Grimes Golden variety, using five conidial cultures from ascospores from different sources. Infection occurred in about six weeks after inoculation in the damp chambers, and in three months outside. The organism was re-isolated in every case. Similar but somewhat less conclusive results were obtained with quinces.

The perithecial stage of the fruit spot organism is believed to be a *Mycosphaerella* agreeing most nearly with *M. pomi* Passer. The black perithecia measure 70 to 100 μ in diameter; the asci approximately 8 to 10 by 40 to 66 μ; and the eight bicellular ascospores 3·5 by 18·8 μ.

COOLEY (J. S.) & FENNER (E. ALINE). **The variability in the black rot fungus of the Apple.**—*Phytopath.*, xvi, 1, pp. 41–46, 1 diag., 1926.

In 1923 and 1924 *Physalospora malorum* [*P. cydoniae*] was isolated from rotting apples in fourteen different localities from southern Georgia to Guelph, Ontario, and from the Atlantic coastal plain to Arkansas. About 6,800 inoculations with fresh and one-year-old cultures were made on apples. In many cases cultures from the same locality exhibited a wide variation in the size of the rot produced in a given time on inoculated apples, the average diameter of the largest rot sometimes being more than twice that of the smallest. As much variation was found within a group of some ten cultures from a certain locality as between similar groups from different localities.

Botryosphaeria ribis and *B. ribis* [var.] *chromogena* were isolated from rots resembling black rot and produced identical symptoms on inoculation into apples [see this *Review*, iv, pp. 614, 636], both the chromogenic and non-chromogenic forms exhibiting variations in pathogenicity resembling those of *P. cydoniae*.

BROOKS (C.) & FISHER (D. F.). **Water-core of Apples.**—*Journ. Agric. Res.*, xxxii, 3, pp. 223–260, 1 pl., 9 graphs, 1926.

The [non-parasitic] watercore disease of apples [the symptoms of which are briefly described: see this *Review*, iv, p. 419] is stated to occur in all the apple-growing sections of the United States, but to be most serious in the arid and semi-arid regions where orchards are under irrigation and where intense sunlight prevails. In the eastern part of the United States, the losses are usually highest in the summer and autumn varieties, while in the north-western States they are heaviest on varieties that are harvested late for the sake of their colour.

Irrigation experiments conducted during a period of six years at Wenatchee, Washington, indicated that apples from lightly irrigated trees developed more watercore than those from heavily irrigated trees, and that apples from trees receiving heavy irrigation, followed by light, usually had more watercore than those from trees receiving light irrigation followed by heavy. An excess of soil moisture late in the season did not tend to increase the amount of watercore. The results of experiments with fertilizers indicate, as a whole, that applications of nitrate or potash fertilizers tend to prevent the development of the disease. Although as a rule large apples

showed a greater susceptibility than smaller ones, it did not apparently follow that forcing apples into more rapid growth by irrigation or fertilizers caused an increase in the percentage of the apples that subsequently developed the trouble. A number of experiments made to determine the effect of artificial shade or enclosure of the fruit in glassine bags or muslin sheeting showed that watercore was much more serious on the apples exposed to sunlight than on those that were more or less shaded. Sunburned apples were extremely susceptible, and it was quite common with such apples for the more exposed half to be affected with watercore, while the shaded half was entirely free from it. It was also noted that the disease increased rapidly as the apples became over-mature.

A close correlation was determined to exist between sap concentration and watercore. Exposed and sunburnt apples had a much higher sap concentration than the more protected ones, and the same was true for the exposed or sunburnt halves of the fruit; further, the concentration of the sap increased with advancing maturity and was correlated with the increase in susceptibility to the disease. The authors therefore consider that watercore is the result of sap exudation under pressure, and that this condition is much more responsible for the occurrence of the disease than variations in rainfall or soil moisture. In their opinion, picking at the proper stage of maturity is the most practicable preventive so far known for the disease.

Further tests showed that small apples made better recovery in storage than the larger ones, while the kind of wrapper had little or no effect on the extent of recovery, which, in most cases, was practically the same in cold as in air-cooled storage. Watercore apples showed a high degree of susceptibility to internal breakdown.

SIMONET. **Le pink rot (pourriture rose) des fruits.** [Pink rot of fruits.]—*Journ. Soc. Nat. Hort. de France*, Sér. 4, xxvii, pp. 93–94, 1 fig., 1926.

The occurrence of pink rot (*Cephalothecium* [*Trichothecium*] *roseum*) on pears near Paris in the autumn of 1925 is recorded. The fungus was isolated and made good growth on carrot and potato agar, and other media, the optimum temperature for development being 20° to 22° C. Affected fruit (which had generally been previously wounded or attacked by scab [*Venturia pirina*]) showed the typical pink rot of the skin and brown discoloration of the flesh, the very bitter taste of which is also characteristic. Control measures should include the application of copper fungicides during growth, and the maintenance of a temperature of 2° to 4° C. in storage.

HILDE (H.). **Sprøiteforsøk mot Paereskurv i Rogaland.** [Spraying experiments against Pear scab in Rogaland.]—*Norsk Havetid.*, xlii, 4, pp. 42–44, 1926.

Excellent results in the control of pear scab [*Venturia pirina*] were obtained in the Rogaland district of Norway in 1924 and 1925 by the application of copper sulphate during the dormant period and Bordeaux mixture in the summer. This method gave much better results than the lime-sulphur schedule.

ANDERSON (H. W.). **Overwintering of Bacterium pruni.**—*Phytopath.*, xvi, 1, pp. 55–57, 1926.

The results of five years' study of the mode of overwintering of *Bacterium pruni* [see this *Review*, iv, p. 616] indicate that, contrary to the views of other investigators, cankers are not a common source of initial spring infection in the Illinois commercial peach orchards. Little difficulty was experienced in the isolation of the bacteria from dead leaves in the spring, and it is therefore considered likely that these bacteria may sometimes be responsible for the initial infection.

The exact means whereby infection occurs are not known, but it is assumed that the large, gelatinous masses of bacteria are blown as dust particles or in fragments of leaves to the new foliage, on which infection readily ensues in the presence of sufficient moisture.

WORMALD (H.). **On the occurrence in Britain of the conidial stage of Sclerotinia cydoniae Schell.**—*Trans. Brit. Mycol. Soc.*, x, 4, pp. 303–306, 1 pl., 1926.

The present paper records the discovery in May, 1925, of the conidial stage of *Sclerotinia cydoniae* on quince leaves at East Malling, Kent, for the first time in England. Only one infection point was seen on each leaf attacked, but eventually the infected portion extended over the whole leaf, which became brown and withered. Sometimes the infection extended from the lamina along the petiole and into the axis of the shoot, which then wilted. The conidia were produced on the upper surface of the leaves, and were at first limited to the regions bordering on the midrib and the main veins, but later they became more generally distributed. Their dimensions were found to be rather greater than those given by Schellenberg, the range of size being 9 to 14 by 10 to 21 μ, and the average size of a hundred conidia being 10·5 by 13·1 μ.

WOLF (F. A.) & DODGE (B. O.). **Anthracnose of Dewberries and its control.**—*North Carolina Agric. Exper. Stat. Bull.* 248, 16 pp., 6 figs., 1926.

The most important disease of dewberries [*Rubus* spp.] in the Sand Hills district of North Carolina is anthracnose (*Plectodiscella veneta*), the estimated loss from which in 1925 was 15 per cent. of the crop. The symptoms of the disease on the canes, fruits, and leaves are briefly described, and the results of experiments in its control are discussed and presented in tabular form. In addition to the usual sanitary measures (especially the removal of all the above-ground parts of the plant immediately after harvest), two applications of fertilizers are recommended, namely, (1) 700 lb. 16 per cent. acid phosphate, 700 lb. 16 per cent. cotton-seed meal, and 600 lb. 12 per cent. kainit, to be given at the rate of 500 lb. per acre, as soon as the canes are tied up in the spring; and (2) 500 lb. 16 per cent. acid phosphate, 1,100 lb. 7 per cent. cotton-seed meal, 100 lb. 25 per cent. sulphate of ammonia, and 300 lb. 12 per cent. kainit, to be applied at the same rate immediately after picking.

Field studies have shown that there are three critical times at which a spray of 4–4–50 Bordeaux mixture should be applied, viz., (1) during August when the new growth is about 1 ft. in length;

(2) as soon as possible after tying up the canes in the spring; and (3) as soon as the petals have fallen. Some figures are given relative to the cost of spraying, from which it appears that the average expenditure incurred in connexion with the operations is $8·00 to $10·00 per acre.

McLean Thompson (J.). **Some general problems of the transport by sea and conservation in store of ripe fruit.**—*Journ. R. Soc. of Arts*, lxxiv, 3823, pp. 328–341, 1926.

In connexion with a general discussion of the problems involved in the transport and storage of ripe fruit, some aspects of the work in progress in the Hartley Laboratories of Liverpool University are described.

During the past three years special attention has been paid to the physiology of maturity of oranges and apples. In mature healthy Valencia oranges the total solids may average 14 per cent. by weight, carbohydrates from 4 to 6 per cent., and alcohol approximately 0·1 per cent. If accumulation of carbon dioxide be permitted, however, at temperatures round 18° C. for ten to thirty days in an enclosed atmosphere, the rind becomes pale, and subsequent exposure for a few days to a free moist atmosphere or in a chamber with restricted aeration at a moderate temperature may lead to a softening of the rind, loss of pitting, and liability to fungous infection. An analysis of such fruit may reveal a fall in total solids to approximately 12 per cent. and of carbohydrates to 1 or 2 per cent., coupled with an increase in alcohol up to 0·5 or 1 per cent. An examination of the tissues shows a general flooding of the intercellular spaces of the outer and part of the inner rind, a slight increase of calcium oxalate, and a marked deposition of hesperidin, the presence of which is indicated by small white specks in the tissue.

At still higher concentrations of carbon dioxide for five to eight days the colour of the fruit turns a dark, dull brown, and the rind becomes highly elastic. The inner rind is fully flooded and yellow or brown in colour. Both the rind and the membranous skin of the fruit segments are extensively marked by white, dot-like masses of hesperidin, while calcium oxalate occurs in abundance in the membranes of the fruit segments and in the vesicles. A chemical analysis of such affected fruit reveals a fall in total solids to approximately 10 per cent. and of carbohydrate reserve to less than 1 per cent., while the alcoholic content may exceed 2 per cent. Oranges showing these last characters are stated to be little known in the fruit trade, the extreme conditions determining their development being of rare occurrence. They were recently observed, however, in a consignment of American oranges transported for 23 days in thermos boxes.

The results of extensive experiments indicate that normal maturity may, under certain controlled atmospheric conditions, be followed by a prolonged period of healthy dormancy both in transport and in store. Thus a large number of Valencia oranges were kept in good condition from October, 1924, to July, 1925, while apples of varied grade have been kept since October, 1925, without cold storage or chemical treatment.

Attention has further been directed to the damage caused by various fungi to Brazil nuts shipped from the Amazon to Liverpool. The existing shipping conditions are believed to favour the spread and activity of these fungi, besides restricting the quantity of nuts which can be conveyed per hold. The cavities in the outer layer of the shell consist of narrow passages which are readily invaded by fungi. The hard walls of the innermost layer contain water and food materials suitable for fungous growth. Certain organisms to which these nuts are commonly exposed [see also this *Review*, i, p. 234] have been found to be capable of traversing the shell in 15 days in the presence of quite a low percentage of free water. Even if the kernel is not actually invaded by fungous hyphae, the infection of the shell induces abnormal respiration, followed by rapid asphyxiation of the kernel, the tissues of which become rancid and gummy. Finally the kernel is reduced to a shrivelled mass of decayed matter in which abundant white granules of calcium oxalate crystals predominate. The writer's experiments (conducted on a commercial scale) indicate that it is possible to transport a full cargo of such produce for at least 40 days under closed hatches without appreciable loss.

The disadvantages of cold storage include its high cost and difficulties of manipulation, placing it beyond the reach of small traders, and the maintenance of atmospheric conditions (primarily of temperature) which are generally abnormal to the fruit and entail a reduction of vitality involving rapid deterioration on removal from storage.

CATHCART (C. S.) & WILLIS (R. L.). **Analyses of materials sold as insecticides and fungicides during 1925.**—*New Jersey Agric. Exper. Stat. Bull.* 424, 16 pp., 1925. [Received March, 1926.]

In this bulletin are embodied the results obtained by the examination of the 138 samples of insecticides and fungicides collected for inspection during 1925 [see also this *Review*, v, p. 45].

Nine brands of Bordeaux mixture were examined, namely: (1) Bordeaux mixture powder (Ansbacher Insecticide Co., Inc., New York), containing 16·41 per cent. metallic copper. (2) Dry powdered Bordeaux mixture (Chipman Chemical Engineering Co., Inc., New York), containing 12·42 per cent. copper. (3) Orchard Brand powdered Bordeaux mixture (General Chemical Co., New York), containing 13·66 per cent. copper. (4) and (5) Key Brand Bordeaux mixture (Interstate Chemical Co., Jersey City, N.J.), containing 11·43 and 13·41 per cent. copper, respectively. (6) Green Cross Dry Bordo (Kil-Tone Co., Vineland, N.J.), containing 22·22 per cent. copper. (7) Powdered Bordeaux mixture, 16 per cent. copper (John Lucas & Co., Inc., Philadelphia, Pa.), containing 16·50 per cent. copper. (8) Fungi-Bordo (Sherwin-Williams Co., Cleveland, Ohio), containing 13·19 per cent. copper. (9) 'Electro' Bordo Mixture (Vreeland Chemical Mfg. Co., Little Falls, N.J.), containing 19·78 per cent. copper.

Only one sample of atomic sulphur was analysed, viz., atomic sulphur (General Chemical Co.), containing 49·08 per cent. total sulphur.

The following sulphur mixtures were examined: (1) Orchard Brand dritomic sulphur (General Chemical Co.), containing 94·45 per cent. sulphur. (2) New Jersey dry-mix sulphur lime [see this *Review*, v, p. 311] (Jersey Orchard Supply Co., Burlington, N.J.), containing 66·74 per cent. sulphur. (3) Sulpho-tone (Kil-Tone Co.), containing 61·28 per cent. sulphur. (4) and (5) Dry-mix sulphur lime (Mechling Bros. Chemical Co., Camden, N.J.), containing 62·58 and 63·02 per cent. sulphur, respectively. (6) 80 sulphur–20 lime dusting mixture (Mechling Bros.), containing 77·44 per cent. sulphur. (7), (8), and (9) Niagara dry-mix, Niagara dry-mix (N.J. formula), and Niagara 80–20 mixture (Niagara Sprayer Co., Middleport, N.Y.), containing 61·06, 62·51, and 77·14 per cent. sulphur, respectively.

The three lime-sulphur solutions examined were as follows: (1) Allen's concentrated lime-sulphur solution (W. A. Allen, Pittstown, N.J.), containing 18·17 per cent. total sulphur in solution at 24° Beaumé. (2) Orchard Brand lime-sulphur solution (General Chemical Co.), containing 24·96 per cent. sulphur at 32° Beaumé. (3) Anchor Brand lime-sulphur solution (Leggett & Bro., Inc., New York), containing 24·84 per cent. sulphur at 32° Beaumé.

Sulfocide (B. G. Pratt Co., New York) contained 32·27 per cent. total sulphur in solution at 41° Beaumé.

The following soluble sulphur compounds were analysed: (1) Dry lime-sulphur (Bowker Insecticide Co., New York), containing 62·46 per cent. total sulphur. (2) and (3) Key Brand dry lime-sulphur (Interstate Chemical Co.), containing 64·65 and 65·48 per cent. sulphur, respectively. (4) Powdered lime-sulphur (Leggett & Bro.), containing 57·66 per cent. sulphur. (5) Dry lime-sulphur (John Lucas & Co.), containing 62·18 per cent. sulphur. (6) Niagara soluble sulphur compound (Niagara Sprayer Co.), containing 52·81 per cent. sulphur. (7) and (8) Dry lime-sulphur (Sherwin-Williams Co.), both containing 60·89 per cent. sulphur.

Analyses of a number of other miscellaneous brands are given.

CERASOLI (E.). **La poltiglia bordolese e la sua solubilizzazione sugli organi verdi della Vite.** [On the solubility of Bordeaux mixture on the green parts of the Vine.]—*Riv. Patol. Veg.*, xvi, 1–2, pp. 17–19, 1926.

The author further develops the theories previously expressed as to the solubility of the copper contained in fungicides after being deposited on the green parts of the vine [see this *Review*, i, p. 388]. The copper in Bordeaux mixture tends to become transformed into copper hydrate, which is sensible to the solvent action of atmospheric factors, especially carbon dioxide, forming a gelatinous suspension. Copper ions are subsequently liberated and are held responsible for the fungicidal action. The green portions of the plant are, under suitable atmospheric conditions, always coated with a minute quantity of soluble copper, sufficient to inhibit the germination of fungal spores.

TWORT (F. W.). **The Twort-d'Hérelle phenomenon.**—*The Lancet*, ccx, 5347, p. 416, 1926.

Commenting on the results obtained with saline emulsions by

Gratia and Rhodes [see this *Review*, v, p. 378], the writer explains that he did not overlook the question of autolysis or isophagy, which is not, in his view, a sufficient explanation of the action of transmissible lysin on dead bacteria. The lysis of dead bacteria, in a suitably arranged experiment, has been found to occur rapidly and to an appreciable extent only when the transmissible lysin is also present. There is, however, a possibility that the lysin does not produce direct lysis, but acts by killing the bacteria in such a way as to liberate autolysins for the production, or assistance in the production, of lysis. There are stated to be several simple chemical methods of setting free the autolysins during the destruction of the bacteria, and these lysins will partially clear a bacterial emulsion killed by heat without the presence of the transmissible lysin.

MULVANIA (M.). **The destructive action of certain bacteria on the virus of Tobacco mosaic.**—*Journ. of Bact.*, xi, 2, p. 98, 1926.

This is an abstract of a paper read before the 27th Annual Meeting of the Society of American Bacteriologists, 29th to 31st December, 1925. Tubes of ordinary bouillon, to which were added definite amounts of filtrate of juice from mosaic diseased tobacco plants, were inoculated with various bacteria, with the result that in some cases the infectivity of the virus was almost destroyed. The organisms which produced this effect, namely, a cellulose-fermenting, thermophilic organism, *Bacillus proteus*, and *B. aerogenes*, had no special characters in common, so far as could be detected, when compared with those that did not appreciably inactivate the virus (*Sarcina lutea*, *B. anthracoides*, and *B. hartlibii*).

SMITH (K. M.). **A comparative study of the feeding methods of certain Hemiptera and of the resulting effects upon the plant tissue, with special reference to the Potato plant.** —*Ann. of Appl. Biol.*, xiii, 1, pp. 109–139, 4 pl., 10 figs., 1926.

In connexion with the transmission of virus diseases of the potato, the author carried out a study of the feeding methods of certain sucking insects.

The insects examined included aphids, coccids, capsids, leafhoppers, and *Asterochiton vaporarium*, the common greenhouse whitefly. Attention was especially directed to determine the leaf surface attacked, the position of the insect on the leaf surface in relation to the veins, the point of entry of the stylets, the paths of the stylets in the tissues (whether inter- or intracellular), the objective of the stylets, the effect of penetration and of the saliva upon the plant tissue, and the method of penetration of the tissue. The results of the observations are given in considerable detail. They indicate that the aphids *Myzus persicae*, *M. circumflexus*, *Macrosiphum solanifolii*, and the whitefly usually pass their stylets between two epidermal cells, and thence intercellularly to the phloem of the vascular bundles. *Macrosiphum solanifolii*, however, often has an intracellular stylet tract. These insects usually attack the under surface of the leaf. The damage done by the saliva is largely confined to the stylet tract, and was slight in the case of the whitefly.

Of the coccids studied, the stylets of *Aspidiotus* generally entered the tissue through an epidermal cell and showed an intracellular path through the parenchyma of the leaf, the phloem not being the objective. The saliva appears to have the property of dissolving the walls of the cells, the contents of which are plasmolysed in the track of the stylets. In the case of the mealy bug *Dactylopius*, whose stylets also penetrate intracellularly, the phloem and xylem elements are always the objectives. These insects attack both stems and leaves, and are generally situated on the latter near or alongside a vein. They have a well-marked stylet track, and their saliva, which is secreted in large, irregular drops, also dissolves the cell walls. Some disorganization of the vascular bundles is caused by these insects.

The capsids (*Calocoris* and *Lygus*) penetrate the tissue by pressure, the intracellular passage of the stylets being facilitated by the disintegrating effect of the saliva secreted. They attack both leaf surfaces and also stem tissues, their objectives being both the cortex and the vascular bundles. The effect of the saliva upon the cells of the plant is considerable, and is described in detail.

In the leafhoppers (Typhlocybidae) studied, penetration of the tissues occurs on both sides of the leaves (the larvae are usually confined to the under side) and is intracellular, the objective being the palisade cells and the vascular bundles. The damage done by the saliva is considerable, the chlorophyll and cell contents being destroyed over a wide area around the puncture, but the cell walls are left intact.

The stylet sheath formed in the plant by the aphids and capsids is thought to consist of substances produced by the reaction of the saliva on the cell sap, the difference in the amount of sheath material produced by the capsids being ascribed partly to the larger quantity of saliva injected by them and partly to its greater toxic power.

Penetration in the capsids and leafhoppers is by mechanical pressure. In the whitefly and aphids it is often through the stomata or between two epidermal cells, the latter being the more usual mode of entry. In the aphids, penetration is assisted by the dissolving action of the saliva on the middle lamellae of the cells, and the same is probably also the case in the coccids.

Discussing the bearing of these observations on the transmission of virus diseases, the author points out that there is little doubt that the phloem elements of the vascular bundles are the most favourable point for starting an infection, as they not only contain substances suitable for the growth of micro-organisms but also facilitate the dispersal of the virus through the plant, this view being also supported by the fact that in some virus diseases a necrosis of the phloem is evident. This would suggest that any insect tapping the phloem of the vascular bundles might be a carrier, thus incriminating, among the insects studied, the three species of aphis, the whitefly, and the mealy bug (*Dactylopius*). The leafhoppers and capsids might also act as carriers when their punctures reach the vascular bundles, but the coccid *Aspidiotus* would, on this assumption, be definitely excluded. In regard to the reaction of the plant to the irritation set up by the stylets and the toxins of the

saliva, the author is inclined to the view that the insects which cause the least possible irritation or disorganization of the plant cells would be the most likely to inoculate the diseases successfully, this again pointing to the aphids, the whitefly, and *Dactylopius* as the most likely vectors of virus diseases.

McKinney (H. H.) & Webb (R. W.). **The dilution method as a means for making certain quantitative studies of viruses.**—Abs. in *Phytopath.*, xvi, 1, p. 66, 1926.

Eight consecutive dilution experiments with tobacco mosaic from a single plant were conducted under greenhouse conditions to test the assumption that viruses increase in plants. All dilutions were made in sterile distilled water. By inoculating the plants of a given experiment with highly diluted virus from the preceding experiment mosaic was obtained in the eighth experiment in practically undiminished amounts from virus which had passed through eight plants and been diluted in water equivalent to 10^{-33}. A single water dilution of this magnitude being much too great to produce mosaic, it is evident that the quantity of virus increased in the plants. All uninoculated controls remained healthy.

Anderson (A.K.). **Biochemistry of plant diseases. Biochemistry of Fusarium lini Bolley.**—*Minnesota Studies in Plant Science, Studies in the Biological Sciences*, 5, pp. 237–280, 1925. [Abs. in *Thirty-third Ann. Rept. Minnesota Agric. Exper. Stat.*, Part I, pp. 10–11, 1925. (Received 1926.)]

A quantitative study was made of the carbon metabolism of *Fusarium lini*, the causal organism of flax wilt. The fungus grew well on media with P_H values ranging from 1·84 to 12·04, the optimum for development being P_H 5 in two cases and 7 in one. The hydrogen-ion concentration of the medium decreased in the presence of ammonium sulphate and increased in that of potassium nitrate.

F. lini made good growth on substrata in which either glucose, levulose, galactose, mannose, xylose, sucrose, maltose, lactose, soluble starch, or inulin constituted the sole source of carbon. The products of metabolism on glucose were mainly carbon dioxide and alcohol (in a ratio approximating to that of a typical yeast fermentation), with traces of succinic acid and glycerol. On xylose the ratio of carbon in alcohol to that in carbon dioxide was nearly 1 : 1 compared with 2 : 1 in glucose.

Carbon dioxide was also the main by-product of metabolism when the fungus was grown on an ethyl alcohol medium, the ratio of carbon in carbon dioxide to that in the mycelium on this medium being 1 : 1, compared with 2 to 4 : 1 on sugars. The final hydrogen-ion concentration of the alcohol medium was P_H 2·57.

The largest quantity of ethyl alcohol formed was 3·24 gm. in 100 c.c., and the highest concentration of alcohol was 4·33 per cent. by volume on 10 per cent. glucose. Ethyl alcohol and carbon dioxide were the main products of metabolism on succinic acid. On glucose the percentage of carbon in the mycelium increases from 40·62 to 52·65 per cent. during the growth of the culture. On alcohol the percentage of increase in the mycelium is greater than when glucose or xylose is the sole source of carbon.

Dufrénoy (J.). **Action des radiations ultra-violettes sur les zoospores de Blepharospora cambivora Petri et de Phytophthora omnivora parasitica.** [Action of ultra-violet rays on the zoospores of *Blepharospora cambivora* Petri and of *Phytophthora omnivora parasitica*.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 4, pp. 270–271, 1925. [Received April, 1926.]

The author describes experiments to test the resistance of zoospores of *Blepharospora cambivora* and *Phytophthora omnivora parasitica* [*P. parasitica*] exposed at a distance of 15 cm. to ultra-violet rays, generated by a mercury vapour lamp with a current of 1·5 amperes and 110 volts, using the Petri method [see this *Review*, iv, p. 381]. They showed that resistance to radiation is evident for several minutes when the zoospores are protected by a thick film of water, but if the film is very thin, an effect is visible in two or three minutes. Radiation prolonged for more than three minutes stops the movements of the zoospores and causes their cytolysis. An exposure of only two minutes appears to have no immediate effect on the movement of the zoospores, but has an after-effect, apparent in the loss of the cilia and the cessation of movement in about five minutes as compared with several hours for spores not exposed to radiation.

Murphy (P. A.) & M'Kay (R.). **Methods for investigating the virus diseases of the Potato, and some results obtained by their use.**—*Scient. Proc. Royal Dublin Soc.*, xviii, 14, pp. 169–184, 2 pl., 1926.

A new and simple method of tuber grafting [see this *Review*, v, p. 122] has been devised for transmitting virus infection to potatoes, which is claimed to give more reliable results than the more usual method of inoculation by means of carrier aphids. This is termed core-grafting and is briefly as follows. A core containing an eye is removed from a healthy tuber by means of a cork-borer about 13 mm. in diameter, and into the hole thus left is pressed a similar, but slightly larger, core, without eyes, from the tuber it is desired to test. The first core can then be used to raise a plant to serve as a control. Organic union in the graft practically always results. In 1923–4 and 1924–5 this form of grafting was tested in relation to certain combinations of mosaic diseases [see this *Review*, iv, p. 692], and of mosaic and leaf roll. The regularity of transmission was found to be probably in direct proportion to the infectiousness of each disease. The diseases were sometimes separated from each other as a result of tuber grafting, so that of five plants infected with a combination of mosaic and streak, four gave the same combination and one streak alone. Of the 22 plants inoculated in 1923–4 with diseases of the mosaic group, 17 became infected, while of the 7 inoculated similarly with leaf roll, all remained healthy. Similarly in 1924–5, 23 out of 24 inoculated gave some form of mosaic, while none gave leaf roll, though all the parents had leaf roll in the combination. Streak was the most generally transmitted disease. In later experiments, leaf roll was successfully transmitted five times (out of a total of 71). The entire suppression of leaf roll can apparently be brought about by incubating the grafted tubers at 20° C.

Other means of infecting potatoes are discussed, namely, cleft grafting carried out on the sprouts, which has been found successful in the case of leaf roll as well as the other forms; shoot grafts, which give positive results always when union is effected, though this is difficult to secure with streak; leaf mutilation; and the use of aphids. Although three species of the latter, namely, *Myzus persicae*, *M. pseudosolani*, and *Macrosiphum solanifolii*, were proved to carry infection in this way, aphids are, as a whole, considered to be very unreliable agents of infection, especially for leaf roll. The capsid *Calocoris bipunctatus* was found, however, to transmit leaf roll.

A method is described whereby the spread of virus diseases in the potato plant may be studied more exactly, by infecting single-stemmed plants at the top and then removing the lateral shoots at intervals and growing them as cuttings. The top of the main shoot, cut off in the operation of grafting, is also grown as a cutting and serves as a control. Experiments have shown that within 14 to 15 days the whole of the stem, including lateral branches and tubers, becomes infected with leaf roll from a diseased scion grafted at the top, though symptoms may not be visible until considerably later. Since no infection is contracted within 10 days at least, the diffusion through the stem is probably rapid.

The occurrence of varieties tolerant to streak has been proved, and methods are suggested for securing other mosaics free from admixture with this disease, and for proving the presence of streak in varieties in which it produces no symptoms.

LUDEWIG (K.). **Beiträge zum Studium der Blattrollkrankheit der Kartoffel.** [Contributions to the study of the leaf roll disease of the Potato.]—*Landw. Jahrb.*, lxiii, 2, pp. 277–303, 1926.

An account is given of a series of experiments, extending from 1923 to 1925, to test the effect on leaf roll of potatoes at Landsberg-an-der-Warthe (*a*) of immersion of the shoots in solutions of mineral salts of varying concentration; and (*b*) of the application to the soil of fertilizers containing potash and phosphoric acid.

In isolated cases the former method partially or totally prevented the accumulation of starch [see this *Review*, iv, p. 148], but the reaction of the plants to the treatment was extremely variable, as previously observed by Hiltner (*Prakt. Blätter*, p. 15, 1919), especially in the case of repeated immersion. Identical effects were produced by sodium, magnesium, iron, calcium, and manganese salts.

No improvement in the condition of the affected plants followed the application of liberal quantities of basic slag, potash, and ammonium sulphate, separately or together.

GOSS (R. W.). **Transmission of Potato spindle-tuber disease by cutting-knives and seed piece contact.**—Abs. in *Phytopath.*, xvi, 1, pp. 68–69, 1926.

In 1925, forty inoculations were made for potato spindle-tuber [see this *Review*, iv, pp. 54, 693] transmission in the field, by cutting healthy seed with a knife previously used on infected tubers, a similar number being made by rubbing together the cut surfaces of

healthy and diseased seed pieces. The contact inoculations resulted in 47·5 per cent. infections, 45 per cent. doubtful infections, and 7·5 per cent. healthy, as compared with 32·5, 47·5, and 20 per cent., respectively, for the knife inoculations. In addition to the symptoms on tops and tubers, there was a reduction of yield, the average in both sets of inoculations being 153 gm. per plant for the disease controls, 602 gm. for inoculated and infected plants, 962 gm. for the doubtful, and 1154 gm. for the healthy controls.

DAVIDSON (W. D.). **Production of healthy stocks of seed Potatoes.**—*Journ. Dept. Lands and Agric. Ireland*, xxv, 3, pp. 281–283, 1926.

An account is given of the attempt which is being made by the Department of Agriculture, Irish Free State, to establish healthy stocks of seed potatoes, free especially from mosaic and leaf roll. The latter, which causes more severe reduction of yield than mosaic, is stated to be rare in Ireland except in a few areas. Efforts to secure stocks of the Champion variety revealed the fact that it was difficult to find plants of this variety free from mosaic. Nine plants in different parts of the country were selected as apparently free from the disease and other seed was imported from Scotland. When grown, however, all but two tubers from Co. Donegal and a batch from Banffshire (Scotland) were found to be affected. Over 200 of the best plants from the latter batch were dug (the tubers from each being kept separate) on the 7th August, and about 5 cwt. of seed was thus obtained. This is now being multiplied, and similar work with other varieties has been commenced.

WEDGEWORTH (H. H.) & ANDERS (C. B.). **Value of certified Irish Potato seed in Mississippi.**—*Mississippi Agric. Exper. Stat. Circ.* 60, 4 pp., 4 figs., 1925. [Received May, 1926.]

A very heavy annual reduction in the Mississippi potato crop is stated to be caused by mosaic disease, and an experiment was conducted in 1925 to ascertain the value of using certified seed in diminishing this loss. Two lots of certified seed, from Nebraska and Wisconsin, respectively, were compared with two lots of ordinary field stock. All the tubers were planted in medium-heavy sandy loam to which a 10–4–4 (P–N–K) fertilizer was applied at the rate of 1,000 lb. per acre. The percentages of mosaic in the two uncertified lots were 68·07 and 32·24, compared with 2·78 and 2·52 in those from Wisconsin and Nebraska, respectively. The affected plants showed a pronounced stunting and gave much lower yields than the healthy ones (110·70 and 136·33 bushels compared with 186·37 and 204·62 bushels from the Wisconsin and Nebraska lots, respectively).

DOIDGE (ETHEL M.). **Wart disease of Potatoes (Synchytrium endobioticum Perc.)**—*Journ. Dept. of Agric. S. Africa*, xii, 2, pp. 161–169, 4 figs., 1926.

An account is given of the recent outbreak of wart disease of potatoes (*Synchytrium endobioticum*) near Johannesburg [see this *Review*, v, p. 319], the potato crop in the affected gardens being estimated at 1,000 bags, chiefly of the Up-to-Date variety. All the gardens have been placed in quarantine.

The symptoms, etiology, and possibilities of control are discussed, and the legislative measures against the disease in South Africa are recapitulated.

GLYNNE (MARY D.). **The viability of the winter sporangia of Synchytrium endobioticum (Schilb.) Perc., the organism causing wart disease in Potato.**—*Ann. of Appl. Biol.*, xiii, 1, pp. 19–36, 1 diag., 1926.

The present investigation was undertaken with a view to finding a rapid method for testing *in vitro* the viability of winter sporangia of *Synchytrium endobioticum*, the usual methods of germination being too uncertain and uncontrollable in the case of this organism to provide a convenient technique.

The experiments described indicate a close correlation between the viability (as measured by their infective power) of the sporangia subjected to various treatments and the staining reaction of their contents when pressed out into acid fuchsin, or into methylene blue after treatment by a strongly alkaline reagent. Infection experiments in pots showed that sporangia, the contents of which, like those of controls, stain faintly, produce a high percentage of infection, while those that stain deeply and rapidly, produce no infection, being presumably dead. There was an intermediate group in which some sporangia stained deeply and others faintly, and this group tended to give less infection than the controls. These results were verified with regard to heat and various antiseptics, the details being given in tabular form.

A method was also evolved for extracting sporangia that have been treated in the soil, without affecting their viability. It is based on the difference in specific gravity of the sporangia (about 1·17) and that of the soil (about 2·5), the extraction of the sporangia being made by shaking up the mixture of sporangia and soil in chloroform (sp. gr. about 1·5), which does not affect the viability of the former. The floating part of the suspension consists mainly of sporangia.

A study of the relation of temperature, time, and viability showed that treatments of the wet sporangia for 5 minutes at 90° C., 15 minutes at 80°, 1 hour at 70°, and 8 hours at 60°, were all equally effective in securing complete sterilization. Dry sporangia were much less easily killed by heat.

Another indication of the viability of the sporangia was found in the appearance of their contents after treatment with alkaline hydroxides. The contents of living sporangia appeared normal, whilst those that were dead were clear and translucent.

Potato experiments, 1925.—*Govt. of Northern Ireland, Min. of Agric. Leaflet* 7, 14 pp., 3 figs., 1926.

A brief description is given of the symptoms of wart disease of potatoes [*Synchytrium endobioticum*] which is stated to occur in isolated areas in Northern Ireland [see this *Review*, v, p. 64]. Tests of three new immune varieties, namely, Arran Consul, Dunaverney, and White Arran Victory, were conducted at nine centres in scheduled districts. The yield of Arran Consul was found to be superior even to that of the productive standard immune variety, Lochar (average increase, 2 tons 9 cwt. per statute acre). The

tubers are also resistant to blight [*Phytophthora infestans*] and possess good keeping and cooking qualities. Further particulars of these and other immune varieties are given, and results of tests of planting at different distances apart are summarized. The inspection and certification service of immune and certain non-immune varieties will be continued in 1926. Purity certificates will not be granted in any instance of substantial infection by leaf roll, black stalk rot [*Bacillus atrosepticus*], or other diseases liable to be carried by the seed.

BOTJES (J. G. O.). **De stand van het vraagstuk der bestrijding van Aardappelwratziekte.** [The position of the question of the control of Potato wart disease.]—*Tijdschr. over Plantenziekten*, xxxii, 2, pp. 33–44, 1926. [English summary.]

Discussing the experiments of Roach and his collaborators in the control of potato wart disease [*Synchytrium endobioticum*] by soil treatment [see this *Review*, iv, p. 696 ; v, p. 249], the writer thinks the feasibility of the method described by them somewhat doubtful. In addition to the high cost of treatment and the necessity of following it up the next year with heavy applications of lime to neutralize the deleterious effects of the sulphur on the growth of most crops, there is some uncertainty whether all the sporangia of the fungus are really destroyed or only retarded in their development by the presence of large quantities of sulphur in the soil. Incontrovertible evidence of the complete eradication of the sporangia can only be furnished by the cultivation of potatoes on a sulphur-treated soil which has subsequently been neutralized by lime.

The only practical method of controlling the disease appears to be the cultivation of resistant varieties, experiments in which are in progress in Holland under the joint auspices of the Laboratory of Mycology and Potato Research, the Phytopathological Service, and the breeders of new varieties [see also this *Review*, iv, p. 503]. A number of new varieties [a list of which is given] have been tested at the Oostwold Experiment Station, and several new immune varieties, such as Triumph, Energie, Bevelander, Alpha, and others have been introduced and are now cultivated in Holland.

The Triumph variety displayed complete immunity during the Ormskirk trials of 1924–5, but in 1923 the writer found three infected plants among 1,197 healthy ones at Oostwold. In 1924 one out of four infected tubers from these plants produced diseased progeny on infected soil, and in 1925 four of the tubers from this latter plant produced diseased hills on intensively contaminated soil, while seven gave rise to healthy offspring. This continuous production of diseased progeny by a plant of the supposedly immune Triumph variety is thought to be possibly due to a bud variation.

Vœu pour l'organisation de la lutte contre la galle verruqueuse. [Proposition as to the organization of the control of wart disease.]—*Rev. Path. Vég. et Ent. Agric.*, xii, 4, p. 277, 1925. [Received April, 1926.]

As a result of the occurrence of wart disease of potatoes [*Synchytrium endobioticum*] in Alsace in August and September, 1925, the

Société de Pathologie Végétale of France drew the attention of the French Government, at a meeting on 4th December, 1925, to the necessity of employing the most energetic measures to prevent its spread. It was stated at the meeting that a considerable sum of money would be placed by Government at the disposition of the necessary services in order to combat potato diseases.

WEDGEWORTH (H. H.) & ANDERS (C. B.). **Seed treatment for the control of Irish Potato scab.**—*Mississippi Agric. Exper. Stat. Circ.* 61, 4 pp., 2 figs., 1925. [Received May, 1926.]

The annual loss from potato scab [*Actinomyces scabies*] in Mississippi is estimated at 50,000 bushels. Experiments were carried out in 1925 to test the value of seed treatment with a solution of 1 in 1,000 corrosive sublimate. The tubers were divided into two lots, scab-free and slightly scabbed, immersed in the fungicide for half an hour, and subsequently planted in heavy sandy loam soil to which 10–4–4 (P–N–K) fertilizer was applied at the rate of 1,000 lb. per acre. Two similar lots of seed were left untreated for controls. The scab-free treated seed produced 96·55 per cent. clean, and 3·45 per cent. scabby but saleable tubers, compared with 23·17 per cent. clean, 63·69 per cent. saleable scabby, and 13·41 per cent. unsaleable scabby tubers from the untreated controls. The corresponding figures for slightly scabbed seed were 93·06 per cent. clean, 6·94 per cent. saleable scabby, and no unsaleable scabby in the treated lot; and 12·35 per cent. clean, 69·17 per cent. saleable scabby, and 18·48 per cent. unsaleable scabby in the untreated lot.

DICKSON (B. T.). **The 'black dot' disease of Potato.**—*Phytopath.*, xvi, 1, pp. 23–40, 1 pl., 3 figs., 1 diag., 1926.

The history, distribution, and symptoms of the potato disease variously known as black dot, dartrose, anthracnose, or foot rot are described [see this *Review*, v, p. 182], and its etiology is discussed. The results of the author's taxonomic studies [details of which are given] indicate that the causal organism of the above-named disease is correctly known as *Colletotrichum atramentarium*, the following being added to the synonyms already given [see this *Review*, v, p. 124]: *Rhizoctonia tabifica* Hall.; *Sclerotium setosum* Bewley & Shearn [see this *Review*, ii, p. 589]; and *C. biologicum* Chaudhuri [see this *Review*, iv, p. 373], cultures of which, examined by the author, developed the amethystine colour and other characters closely similar to those of *C. atramentarium*. The examination of exsiccata of *Vermicularia herbarum* and *V. orthospora* was inconclusive as regards the former; the latter agreed somewhat closely with *C. atramentarium*, with which it was evidently allied though not identical. A new combination, *C. orthosporum*, has therefore been made for this organism.

The morphology and cultural characters of *C. atramentarium* are described. The black sclerotia range from 100 μ to 0·5 mm. in size. The two- to four-septate setae measure 80 to 350 μ in length, and the one- to three-guttulate conidia, 3 to 7·5 by 17·5 to 22 μ.

The organism is stated to be a weak parasite, attacking mainly young or debilitated plants. Control measures should include crop rotation in cases of severe contamination and the treatment of

seed-tubers with hot formaldehyde. The Green Mountain and Delaware varieties appear to be more susceptible than Beauty of Hebron and Cobbler.

WEIMER (J. L.). **Further evidence of the non-transmissibility of the so-called Sweet Potato mosaic.**—Abs. in *Phytopath.*, xvi, 1, p. 74, 1926.

Nancy Hall sweet potatoes showing mosaic symptoms [see next abstract] were carried through three generations under different environmental conditions. Healthy plants, with vines growing intermingled with those of diseased individuals, showed no sign of infection in the second generation. Negative results were given by attempts at transmission by the usual mechanical means, as well as by grafting halves of diseased on healthy sweet potatoes. Portions of diseased vines were grafted on to healthy roots and vice versa. The healthy vines remained healthy after eight months' growth on diseased roots, while the diseased vines on healthy roots remained diseased.

ROSEN (H. R.). **Sweet Potato mosaic and its incubation period of two growing seasons.**—Abs. in *Phytopath.*, xvi, 1, p. 74, 1926.

The writer's investigations and those of other workers have shown that sweet potato mosaic [see preceding abstract] is certainly not communicable as regards the development of recognizable symptoms during one growing season. Several years' experiments indicate, however, that the disease has a remarkably long incubation period, no symptoms appearing in less than two consecutive growing seasons. Furthermore, there is usually a gradual increase in the severity of the disease in the progeny of inoculated plants.

MAGARINOS TORRES (A. F.). **Defesa Sanitaria Vegetal.** [The Plant Protection Service.]—*Inst. Biol. de Defesa Agricola, Rio de Janeiro, Bol.* 5, 80 pp., 6 figs., 1925. [Received May, 1926.]

This paper gives a general survey of the origin and development of the Plant Protection Service, established in Rio de Janeiro, Brazil, in 1910. The quarantine regulations introduced since 1921 with a view to the protection of plants against the importation of foreign diseases and pests are listed, and an account is given of the inspection service maintained for the purpose of enforcing them.

Citrus scab (*Cladosporium* [*Sporotrichum*] *citri*) is stated to occur in the citrus-growing areas of Rio de Janeiro, Bahia, São Paulo, Santa Catharina, and Rio Grande do Sul, and an internal inspection service of all plant nurseries is being developed in order to control the spread of this disease and of certain insect pests also prevalent in various States. The Nichteroy notification of 11th April, 1922, prohibits the exportation of citrus plants from the infected areas unless the consignment is accompanied by a certificate from an accredited official attesting their freedom from disease. Examples of the type of certificates used in this and other cases are appended.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

Vol. V AUGUST 1926

SHARPLES (A.). **Treatment on 'wet root rot' in Malaya caused by Fomes pseudoferreus.**—*Malayan Agric. Journ.*, xiv, 2, pp. 32–36, 1926.

The recent inspection of an estate with 12- to 14-year-old rubber (*Hevea brasiliensis*) trees revealed a high incidence of wet root rot (*Fomes pseudoferreus*). The usual control measures were adopted, namely, trenching and the uprooting and burning of badly diseased trees. It was further found possible to treat a number of infected individuals by the severance of the lateral roots behind the diseased area. Infection was found to be generally restricted to lateral roots in the upper nine inches of soil, so that there appears to be little danger of the fungus infecting the tap root at a lower level. In Malaya infection is by root contact, and mature fructifications of the fungus have not been observed. Twenty-three out of 41 diseased trees were treated by this last method in July, 1925, and it is believed that the spread of infection to the 57 healthy individuals in proximity to these individuals has thereby been prevented. The remaining 18 trees were destroyed. From August to December, 1925, the total number of trees treated by the severance of the lateral roots was 185 out of 753 examined, while 212 were taken out, the remaining 356 being healthy. Thus practically 25 per cent. of the diseased trees have been saved by this method, and the spread of infection has been arrested. The cost of treatment is estimated at just under \$3 per tree [\$1 = approx. 2s. 4*d*.], a total of approximately \$2,250 having been spent on the work.

The trees treated by severance of the lateral roots fall into two groups, viz., (*a*) those requiring severance at a distance of many feet from the tree; and (*b*) those in which infection had almost reached the junction of stem and root. In a few cases the drastic root pruning somewhat affected the health of the latter group.

Judging by the data available, wet root rot appears to occur in cycles, the first occurring about the tenth and the second in the fifteenth year after planting. The latter group would be detected

by following up the roots of apparently healthy trees adjacent to those treated at the first onset, and could probably be saved by treatment at that time.

In connexion with the taxonomy of the fungus, the writer states that he has obtained further immature specimens which he cannot visualize as developing into anything resembling Van Overeem's *Ganoderma ferreum* [see this *Review*, v, p. 54].

JONES (L. R.). **The relation of fungi to soil deterioration.**—*Journ. Amer. Soc. Agron.*, xviii, 2, pp. 150–153, 1926.

This is the outline of a discussion presented as a part of the symposium on soil deterioration at the meeting of the American Society of Agronomy at Chicago on 16th November, 1925.

In phytopathology some of the most complex problems are concerned with soil-borne diseases, and during the last thirty-five years (the period of more or less comprehensive and intelligent record of plant disease incidence in the United States), a constant increase has occurred both in the numbers and prevalence of these diseases—a movement bound to continue indefinitely.

The most important factors in the fundamental research on, and adequate control of, these soil-borne diseases are (1) constant vigilance against the introduction of such parasites into new territory and their subsequent dissemination; (2) persistent efforts in the protracted investigation of the relation of environment to the occurrence and severity of soil-borne diseases [see this *Review*, iv, p. 304]; and (most significant of all from a practical standpoint) the problem of susceptibility and resistance of the host plants to soil-borne diseases. In this connexion it is pointed out that quarantine merely delays the inevitable dissemination of all soil-borne parasites of the major crops, which become increasingly virulent in proportion to their adaptation to local conditions. Soil sterilization (the only effective method of control) is merely a costly local palliative of purely temporary efficacy. Rotational problems involve important relations of soil fertility, soil physics, and economic expediency, which must not be unduly interfered with by the exigencies imposed by diseases. The development of disease-resistant crops is more important in the case of soil-borne parasites than in any other class of disease.

The great need for co-operation between scientists and practical agriculturists and horticulturists is emphasized.

B[ARBER] (C. A.). **The Coimbatore Cane seedlings in Bihar.**—*Intern. Sugar Journ.*, xxviii, 326, pp. 75–77, 1926.

In reviewing the report of the Secretary of the Indian Sugar Bureau for 1924–5 the author calls attention to the fact that the Coimbatore canes Co 210 and 213, which are susceptible to mosaic in India (especially the latter), are derived from the Java cane POJ 213, a well-known mosaic carrier, whereas Co 214, a seedling of Striped Mauritius crossed by a Coimbatore seedling (Saretha × *Saccharum spontaneum*), was practically free from mosaic. The two former were also liable to smut while Co 232, a later introduc-

tion from which much was hoped, was still more affected by both mosaic and smut than these.

In spite of this, Co 213 is still regarded as the best of the Coimbatore series of canes so far tested under Bihar conditions.

SMALL (W.). **On the identity of Rhizoctonia lamellifera and Sclerotium bataticola.**—*Trans. Brit. Mycol. Soc.*, x, 4, pp. 287–302, 1 pl., 1926.

Since the publication of his paper describing a root disease of *Grevillea robusta*, *Bixa orellana*, *Coffea robusta*, and *Casuarina equisetifolia* [see this *Review*, iii, p. 748], attributed to *Rhizoctonia lamellifera*, the author has investigated further isolations of the fungus, and studied it in culture parallel with another sclerotium-forming fungus that was described by him as being associated with a hot-weather wilt of French beans (*Phaseolus vulgaris*) in Uganda, and identified as *Sclerotium bataticola* Taub. [see this *Review*, iv, p. 508]. The two fungi proved to be indistinguishable in culture, and, giving preference to the strong similarity of their vegetative growths over the presence of a supposed hymenophore (which was very imperfect) and of the very scarce clamp-connexions in the former, the author considers it advisable to identify it with *Sclerotium bataticola* and to drop the name *Rhizoctonia lamellifera*. [As already reported in this *Review*, v, p. 20, the name *Rhizoctonia bataticola* has been recently proposed for this fungus.]

Continued investigation has shown that the fungus is widely distributed in all the planting districts of Uganda, with the exception of one district that has not yet been searched. The list of host plants has been extended to include *Coffea arabica*, three species of *Erythrina* (*indica*, *umbosa*, and *velutina*), two species of *Albizzia* (*moluccana* and *stipulata*), cacao (*Theobroma cacao*), a species of *Sesbania* (probably *S. punctata*), a garden croton (*Codiaeum* sp.), a species of *Eucalyptus* (probably *E. globulus*), two species of *Cupressus* (*macrocarpa* and *benthami*), a garden aster (*Callistephus* sp.), and a vetch from Palestine, the name of which is unknown; while it is considered probable that the rain tree (*Pithecolobium saman*) will prove to be a further host. It is pointed out that all the above hosts are not indigenous to Uganda; the majority were destined to be ornamental plants or shade trees for coffee and cacao, and their loss is felt the more severely in that their death does not occur until the trees are large enough to fulfil their purpose.

A method was devised [and is briefly described] by which sclerotia from the woody hosts were induced to germinate, and the seven new strains thus obtained were grown in culture. Sclerotial plates, such as are characteristic of the fungus in the roots of woody plants, were not obtained in culture, even on sterilized blocks of their original hosts, nor has the supposed hymenophore been found a second time. Pigmentation of the culture media was found not to be a specific character of the different strains. Inoculation and cross-inoculation experiments were only partly successful. In the majority of cases infection in the field seems to depend more upon the susceptibility of the host and the presence of the fungus in the soil than upon the factors which control environmental

conditions. The new strains produced a typical charcoal rot on sweet potato.

SPEGAZZINI (C.). **Observaciones y adiciones a la micología argentina.** [Observations on and additions to Argentinian mycology.]—*Bol. Acad. Nac. Cien. Córdoba,* xxviii, pp. 267–406, 27 figs., 1926.

In this annotated list of Argentine fungi the following species of Polyporaceae are stated to occur (pp. 351-390) on living plants. *Fomes auberianus* on trunks of old living trees [unspecified]; *F. betulinus* on an old trunk of *Nothofagus procera*; *F. fasciatus* on a very old living trunk [unspecified] and on *Cedrela* sp.; *F. fruticum* on living branches of *Allophylus edulis* and wild and cultivated guava (*Psidium* spp.); *F. pappianus* on old rotten, but living trunks of *Vàchellia lutea*; *F. platincola* n. sp. [with Latin and Spanish diagnoses] on an old, living, partly decorticated trunk of *Tamarix africana*; *F. rimosus* on living trunks of undetermined species and on *Ocotea acutifolia*; *F. semitostus* on large, standing trees [unspecified]; *Ganoderma fornicatum* on trunks of *Citrus aurantium* in Buenos Aires, Entre Ríos, and Tucumán: this fungus, characterized by ellipsoid to pyriform, smooth, pale iron-coloured spores, measuring 9 to 11 by 5 to 6 μ, is stated to be apparently peculiar to the Aurantiaceae, to which it may cause serious injury; *G. lorentzianum* on old living trunks (especially near the base) of *Acacia dealbata*; *G. platense* n. sp., found on the living roots of various trees in the riparian forests of Buenos Aires in 1923 and 1924; *G. sceleton* on an old living trunk [unspecified]; *Gloeoporus rhipidium* on the bark of old living trunks; *Polyporus coruscans* on decayed but living trunks of *Acer negundo* and occasionally on *Morus alba* and *Melia azedarach*; *P. ochroleucus* on old, rotten, but living trunks of carob bean trees (*Prosopis* sp.); *P. sulphureus* on the base of old living trunks of *Eucalyptus globulus* and *E. amygdalina*; and *Polystictus fontanai* on decayed scars of living trunks of *Quercus sessiliflora*. *F. lignosus*, *Ganoderma applanatum*, and *G. lucidum* are also recorded on various unspecified hosts.

SLAGG (C. M.). **New and unusual diseases and injuries of Tobacco.** —*Scient. Agric.*, vi, 6, pp. 193–198, 6 figs., 1926.

Among the items of information contained in the present paper the following are of interest.

During the summer of 1922 tobacco, chiefly of the Connecticut Broadleaf variety, grown on a number of adjoining farms in the neighbourhood of the village of Windsor Locks, Connecticut, was found to be attacked by a disease for which the name curly dwarf is suggested. Since then it has also been observed at Harrow, Ontario, on the White Burley and Green River varieties, and at Albion Prairie, Wisconsin, on Connecticut Havana No. 38 and other cigar binder strains. In Connecticut, in the district where the disease is most prevalent, experienced growers call the affected plants 'mongrels', and state that the trouble is of long standing. On plants badly affected the leaves are distorted, wrinkled into folds on the surface, and the edges and tips are sharply recurved downward and inward. The internodes are considerably shortened.

Sunken greyish-brown to slate-coloured spots are found on the under surface of the midribs and veins, and on the stalk. The entire plant appears as a rosette of wrinkled, bulging, and very brittle leaves close to the ground. At a still later stage the spotting may occur on the upper surface of the leaves, and the leaf tissues may break down. In the field, however, the symptoms vary considerably in their severity, from the above-described appearance to plants of normal size only showing a slight wrinkling and recurving of the upper leaves. Although partial recovery has been observed, usually a plant showing curly dwarf when young becomes progressively worse. From mosaic the disease is distinguished by the fact that there is never any variation in colour or thickness of the leaf lamina, and also by the characteristic lesions on the veins and stalks, and the extreme brittleness of the curled leaves. All attempts to find a causal organism for the disease, either by isolation or microscopic investigation of the affected tissues, have failed, and inoculations with the macerated tissues and by means of aphids have been unsuccessful. So far as is known at present, the disease does not appear to be of great economic importance.

Since the summer of 1918 a distinctive type of leaf spot has been occasionally observed on the leaves of tobacco plants, both in seed-beds and in the field, in Kentucky, Wisconsin, Connecticut, and Massachusetts. On large plants in the field the spots are confined to the lower leaves close to the ground; they are scattered irregularly over the whole surface, roughly circular in shape, light brown in colour, and usually much more prominent on the upper side of the leaf. In addition, plants attacked in the seedling stage exhibit a variety of symptoms, ranging from a type of damping-off in very humid air, to a slight browning or girdling of the stems in drier conditions. In seedlings the infection appears to progress from the leaves towards the stems. Under the microscope the affected areas were found to contain the mycelium and abundant conidia (hyaline, one-septate, straight or slightly curved, tapering slightly towards the apex, and averaging 3 by 12 μ in size) of a fungus closely resembling *Fusarium affine* Faut. & Lamb. Inoculations with this organism on tobacco seedlings in the greenhouses at Madison, Wisconsin, reproduced the symptoms of the disease. The fungus grows slowly in culture, producing very little aerial mycelium, but a great number of white- to salmon-coloured conidia on potato dextrose agar.

SOROKIN (HELEN). **The destruction of the chloroplasts in Tomato mosaic.**—Abs. in *Phytopath.*, xvi, 1, pp. 66–67, 1926.

Tomato mosaic is stated to be accompanied by a progressive disintegration of the chloroplasts. In the early stages refractive, crystalline bodies, and others actively motile, appear within the chloroplasts; these are followed by a blister-like swelling on one side of the chloroplast, which gradually shrinks as the swelling expands, and finally disappears. At this stage one or more of the crystalline bodies may be seen within the blister-like spheres, which are almost transparent but readily discernible on staining with very dilute gentian velvet. They are specially abundant in the chlorotic areas of mosaic tissues. They are easily destroyed by

certain chemicals, while the motile bodies are extremely resistant to 80 per cent. alcohol, 30 per cent. acetone, and weak acids, though sensitive to weak alkalis. These two types of bodies, whether causal or incidental, are stated to be constantly associated with the destruction of the chloroplasts.

JONES (P. M.). **A mycetozoan found in Tobacco plants with mosaic-like symptoms.**—Abs. in *Phytopath.*, xvi, 1, p. 67, 1926.

An intracellular mycetozoan, which has been named *Plasmodiophora tabacum* n. sp., was found in tobacco plants showing symptoms resembling mosaic. Invaded cells become necrotic and adjacent ones hyperplastic. Plasmodia occur in all the tissues except bast fibres and xylem. Plasmodia from naturally and artificially infected plants give rise, on sterilized Knop's solution, to amoebae or flagellates with one flagellum, mitotic division taking place in both. Flagellates are formed also by conjugation in pairs of gametes produced from chromidia discharged by the nuclei of mature amoebae. The cysts produced by amoebae and flagellates give rise to amoebae which fuse into plasmodia. These soon become granular and vacuolate, forming free spores in a row, the nuclei of which discharge chromidia previous to the development of three to sixteen cyst spores, which germinate and produce the amoebae limax. Similar organisms are stated to occur in leaf roll or mosaic potato and mosaic tomato plants.

VALLEAU (W. D.), KENNEY (R.), & KINNEY (E. J.). **Root-rot of Tobacco in Kentucky and its control.**—*Kentucky Agric. Exper. Stat. Bull.* 262, pp. 157–180, 6 figs., 1925. [Received April, 1926.]

An account is given of a series of tests made since 1920 at the Kentucky Experiment Station to compare the relative resistance of varieties and selected strains of Burley tobacco to black root rot caused by *Thielavia basicola* [see this *Review*, ii, p. 37; iv, p. 720].

A survey based on observations of various fields and on comparative rates of growth of resistant and susceptible strains of tobacco during five years indicated that this disease causes extensive injury in 30 per cent. of the Kentucky tobacco fields each year, and to a lesser extent in another 10 to 20 per cent. The commonly grown varieties of stand-up and drooping Burleys are, as a rule, highly susceptible to attack, but resistant strains of Judy's Pride, Vimont Kelley, and Pepper have been found, and in heavily infested soils have been observed to make nearly normal growth, under the existing temperature conditions of the State. They are less resistant than the cigar variety, Kentucky Yellow, but more so than the dark tobacco varieties. In the north, at lower temperatures, the same selections show no resistance.

The results so far obtained indicate that it is possible to obtain strains which combine good quality with resistance to root rot, and, on an average, the quality of the resistant selections is slightly higher than that of the local varieties, owing to a greater uniformity of type.

WHITE (R. P.). **Tomato wilt investigations.**—*Kansas Agric. Exper. Stat. Tech. Bull.* 20, 32 pp., 3 figs., 1 map, 13 graphs, 1926.

Since 1919 the most serious tomato disease in Kansas is stated to be the wilt caused by *Fusarium lycopersici*. The losses from this disease have gradually increased, and in 1924 were estimated at about 10 per cent. of the entire crop. Individual losses of 20 to 30 per cent. are common in the extreme south-east of the State, where almost total failure of the crop has been observed in some cases.

The investigations reported in this paper deal with the influence of certain environmental factors on tomato wilt and with the relative resistance of a number of tomato varieties and hybrids to the disease when grown under field conditions in heavily infested soil.

The data obtained during 1921–3 are shown in the form of graphs representing the air and soil temperatures, rainfall, and percentage of wilt mortality weekly for each season, and confirm the greenhouse results previously obtained by Clayton [see this *Review*, ii, p. 477] in that tomato wilt is favoured by a high temperature and at least medium soil moisture.

The variety tests indicate that certain varieties resistant under one set of conditions may be less resistant or even susceptible under another. Of the 29 varieties tested, the majority proved susceptible, but the following six introduced into the State for trial purposes have shown resistance: Louisiana Red, Louisiana Pink, Marvel, Norton, Norduke, Marvana, and Kanora.

DUFRÉNOY (J.). **Rouge et chute des aiguilles de Pin sylvestris.** [Reddening and fall of the needles of *Pinus sylvestris*.]—*Rev. Eaux et Forêts*, lxiv, 2, pp. 95–96, 1926.

The reddening and fall of the needles of *Pinus sylvestris* may be due to a variety of causes; for instance, the action of noxious gases; abrupt alternations of temperature in the spring; and decay of the roots, collar, or branches. If these symptoms are not accompanied by a brown discoloration of the root and branch tissues, they are probably due to the attacks of *Lophodermium pinastri*, which is prevalent on young individuals of *Pinus sylvestris*, the black pine [*Pinus nigra*], and the mountain pine [*P. monticola*].

The first symptom of the disease caused by *L. pinastri* is the appearance on the green needles of yellow zones, rendered translucent by the accumulation of resin in the outer tissues, which are permeated by the hyphae of the fungus. Towards the end of the summer the infected needles show brown transverse zones separated by more or less distinct black rings. The red discoloration becomes more pronounced during the winter, and is followed, in April to May, by the fall of the needles.

Minute, black pycnidia develop on both sides of the midrib of the reddened needles. Black, olive-shaped, concave perithecia are formed later on the affected parts of the dry needles attached to the tree or fallen to the ground. Abundant humidity is required for the production of these organs, and after mild, damp winters

they liberate large numbers of ascospores, which form the starting-point of fresh infection.

The disease, which is stated to be of negligible importance under forest conditions, may be controlled in the nursery in its early stages (when only about half the needles are affected) by the application of a 1 to 2 per cent. alkaline (blue) Bordeaux mixture [see this *Review*, iv, p. 715] (1) before June, when the needles are half developed; and (2) at the beginning of July. In colder regions the corresponding times are (1) from the middle of July to 1st August; and (2) between the middle of August and 1st September. The location of nurseries near hardwood plantations and the use of mineral fertilizers are recommended.

TUBEUF (C. v.). **Eine neue Erkrankung der Weisstanne.** [A new pathological condition of the Silver Fir.]—*Zeitschr. für Pflanzenkrankh.*, xxxvi, 1–2, pp. 1–6, 2 figs., 1926.

In July, 1925, the writer examined some silver fir [*Picea excelsa*] branches from Kronach, Upper Franconia (Bavaria), which showed a complete yellow discoloration of the leaves (sometimes affecting the entire shoot system) and a partial variegation of the needles. The branches bearing exclusively yellow needles shed these entirely and died off themselves; while those with some quite yellow and some variegated needles shed the former prematurely and retained the latter. The disturbance, which extends over an area of two hect., is stated to affect primarily the lower and central portions of the crown. The premature shedding of the needles is thought to be possibly due to the alternating periods of heavy rain and drought during the summer, but the actual cause of the variegation remains obscure [see also this *Review*, iv, p. 517]. Measures suggested for the control of the disease include testing the effect of applications of carbonate of lime, ferrous sulphate, or copper sulphate, and modifications of silvicultural practice.

GEORGÉVITCH (P.). **Armillaria mellea (Val.) Quél., cause du dessèchement des forêts de Chêne en Yougoslavie.** [*Armillaria mellea* (Val.) Quél., causing the desiccation of Oak forests in Jugo-Slavia.]—*Comptes rendus Acad. des Sciences*, clxxxii, 7, pp. 289–491, 1926.

The renowned oak forests in Slavonia (Jugo-Slavia) are stated to be undergoing a crisis that threatens their existence, in that since 1902 an increasingly large number of trees of all ages, from young saplings to 200-year-old oaks, perish annually. In the forests along the banks of the river Save, to the east of Sisak, the volume of the dead trunks is estimated at over 500,000 cu. m. In the author's opinion, this high mortality cannot be accounted for by attacks of insect pests and leaf parasites (e. g., *Microsphaera alni* f. *quercina*) [*M. quercina*] or by unfavourable soil conditions, and his researches lead him to the view that it is due, to a considerable extent, to attacks of *Armillaria mellea*, the mycelium of which was found by him commonly on the roots and at the base of the trunks.

GRAVES (A. H.). **The present continued development of basal shoots from blighted Chestnut trees.**—*Science*, N.S., lxiii, 1623, pp. 164–165, 1926.

The frequent appearance of healthy chestnut sprouts from the

bases of trees apparently killed by blight (*Endothia parasitica*) has led to a popular belief in America that such individuals are on the way to recovery [see this *Review*, iv, p. 711]. Inoculations by the writer of the roots of some of these sprouts resulted after a year in a very slight growth of the fungus, while shoots inoculated with the same pure culture at the same time were rapidly girdled. Evidently the root collar and the root tissues are partially resistant to infection by *E. parasitica.* The substances (possibly tannin compounds) which are thought to confer this resistance are apparently absent from the stem tissues, or present in smaller amounts. Recent work at the Leather and Paper Laboratory of the Bureau of Chemistry, United States Department of Agriculture, has shown that there is more than twice the amount of tannin, which is known to exert an inhibitory effect on the growth of the fungus, in the bark of the roots than in that of the stem.

ALTONA (T.). **Aantasting van Tectona grandis L. f. (Djati) door Corticium salmonicolor B. et Br. (Djamoer oepas).** [Infection of *Tectona grandis* L. f. (Djati) by *Corticium salmonicolor* B. et Br. (Djamoer oepas).]—*Tectona*, xix, i, pp. 31–53, 8 pl., 1926. [English summary.]

The disease of teak (*Tectona grandis*) described by the writer under the name of 'heart rot' [see this *Review*, iii, p. 9] has been shown by Dr. Schwarz's investigations [see this *Review*, v, p. 67] to be due to *Corticium salmonicolor*.

Recent inspections of the teak plantations in West and Central Java have in several cases shown 15 to 20 per cent. of infection, and under conditions favourable to the development of the fungus these figures may be at least doubled. In such cases, also, the death of affected branches, shoots, or stems may ensue, whereas normally the effects of the disease are limited to large clefts in the bark, which apparently cause no permanent damage to the tree.

In the old teak forest of Saradan (Madioen), 55 per cent. of the 3,100 trees were attacked by *C. salmonicolor*, which had caused the formation of large, deep fissures, sometimes saturated with water. It was observed that 73 per cent. of the trees in this forest were hollow, and there is some reason to suppose that this condition is correlated with the development of the fungus.

The attacks of *C. salmonicolor* on teak may be minimized by the elimination from the forests of a number of other susceptible hosts, e. g., *Butea monosperma*, *Schleichera oleosa*, *Tamarindus indica*, *Acacia leucophloea*, *Cassia siamea*, *Leucaena glauca*, and *Pithecolobium dulce*; by wide planting and early thinning; and by the removal of severely diseased trees at frequent intervals.

SCHILLING (L.). **Die Dauer rotbuchener Eisenbahnschwellen.** [The duration of Copper Beech railway sleepers.]—*Zeitschr. für Forst- u. Jagdwesen*, lviii, 2, pp. 65–69, 1926.

An investigation on the durability of variously treated copper beech [*Fagus ferruginea*] railway sleepers, under the joint conduct of the Prussian Silvicultural Experiment Station and the Central Railway Board, has been in progress since 1897. Details are given of the different methods of treatment. In series A, 77- to 90- and 160-year-old wood was impregnated by the Rütgers carbolic and

coal-tar process. In series B, 85-year-old wood was impregnated with a zinc chloride solution (4·5° Baumé) at 15° C., with the addition of 6 kg. coal-tar oil per sleeper. Of the total number of sleepers (455) treated in 1896–7, only eight (1·8 per cent.) have had to be removed on account of decay. Leaving out of account the wood felled in summer, which appears to be generally less suitable for constructional purposes, only one out of 385 sleepers has been changed, the rest being still in perfectly good condition. The presence of red heart wood (one-sixth to one-quarter of the cross-sectional area) does not appear to prejudice the durability of the timber, except when it occurs at the periphery.

FALCK (R.) & MICHAEL (S.). **Die Bedeutung des Sublimats als Holzimprägnationsmittel.** [The importance of sublimate as a timber preservative.]—*Zeitschr. Angew. Chemie,* xxxix, 6, pp. 186–193, 1926.

The properties of corrosive sublimate as a timber preservative are fully discussed under two headings, namely, (*a*) its fungicidal protective value and the means of estimating this; and (*b*) its chemical and physical reactions with the wood fibres.

The results of eight years' investigations at the Rütgers works have shown that corrosive sublimate ranks only third in fungicidal value, the first place being occupied by various arsenical compounds and the second (with half the efficacy) by sodium fluoride. Approximately of equal value with corrosive sublimate are the dinitrophenol and dinitrocresol salts, while zinc chloride and copper sulphate are much less effective.

On the other hand, corrosive sublimate is superior to all other timber preservatives in adsorptivity; hence its great value in the impregnation of telegraph poles and the like. It should, however, only be applied to the upper parts, since it is an inadequate protection for the bases, which, beiug embedded in the soil, are more exposed to the attacks of fungi and to the effects of leaching out. It is also unsuitable for railway sleepers and underground constructional purposes. Of all the preparations tested, sodium fluoride penetrates most rapidly and with the least decline in strength into the deeper layers of the wood. A mixture of corrosive sublimate and sodium fluoride [see this *Review*, v, p. 68] would probably combine the advantages of both and should be tested in the open on a large scale.

WALKER (J. C.). **Studies upon the inheritance of Fusarium resistance in Cabbage.**—Abs. in *Phytopath.*, xvi, 1, p. 87, 1926.

By selfing individual cabbage plants through three generations, a line has been established which is apparently homozygous for resistance to yellows (*Fusarium conglutinans*) [see this *Review*, v, p. 74]. Susceptible individuals have been similarly selected from commercial varieties. The F_1 hybrids from several crosses between resistant and susceptible individuals were nearly all healthy. Of the 1,135 F_2 hybrids grown in 1925 on infested soil, 843 were completely healthy and 292 diseased, giving an approximate segregation of three resistant to one susceptible. Several F_1 plants were crossed with a susceptible individual. Of the 151 F_2 hybrids, 77

were completely healthy and 74 diseased. Segregation was, therefore, close to the 1 : 1 ratio. These data indicate that resistance to yellows, as expressed in field environment, is a dominant unit character.

WALKER (J. C.), MONTEITH (J.), & WELLMAN (F. L.). **A new Fusarium resistant Cabbage.**—Abs. in *Phytopath.*, xvi, 1, pp. 72–73, 1926.

A line of the Glory of Enkhuizen variety of cabbage has been isolated which appears to be very uniform in type and practically homozygous for resistance to *Fusarium* [*conglutinans*] in the field. Individuals of this line have been crossed with susceptible individuals, with the result that the F_1 hybrids exhibited practically complete resistance.

TIMS (E. C.). **On the nature of resistance to Cabbage yellows.**—*Journ. Agric. Res.*, xxxii, 2, pp. 183–199, 2 graphs, 1926.

The writer's studies on the nature of resistance to cabbage yellows (*Fusarium conglutinans*) indicate that there are no significant differences in the root systems of resistant and susceptible plants. Resistant plants do not form callus cells after wounding more rapidly or in thicker layers than do those of susceptible varieties.

It was ascertained that plants of resistant varieties are commonly invaded to a limited extent by the yellows fungus. This suggests the possibility of the existence of substances in the plant which are toxic to the hyphae of the fungus [see also this *Review*, iv, p. 519]. It was apparent that the property of resistance in certain strains or varieties is not based on morphological differences or on variations in cell sap acidity. There was no consistent difference in the effect produced on the fungus by juice extracts from resistant or susceptible plants, while water extracts from resistant plant tissues dried at 40° to 80° C. exercised no inhibitory action on the development of *F. conglutinans*. The fungus developed over a hydrogen-ion range of P_H 3 to 9 on the several media tried.

Cabbage plants contain sulphur in appreciable quantities in the form of glucosides as well as volatile sulphur, and it is suggested that resistant cabbage plants may contain a sulphur compound, possibly in the form of a glucoside, in sufficient amounts to account, in part at any rate, for the resistance factor.

WEIMER (J. L.). **Ringspot of crucifers caused by Mycosphaerella brassicicola (Fr.) Lindau.**—*Journ. Agric. Res.*, xxxii, 2, pp. 97–132, 6 pl., 2 figs., 1926.

Cruciferous crops in the San Francisco Bay region and Oregon are subject to ringspot (*Mycosphaerella brassicicola*), which causes losses of 1 to 25 per cent., especially during wet seasons. White and black broccoli, cauliflower, Brussels sprouts, cabbage, yellow turnip, and kale are susceptible in the order named. White turnips and radishes appear to be immune.

Practically all parts of the various hosts are susceptible to infection, the resulting symptoms of which are described in detail. The pycnidia and perithecia of the fungus may be arranged in concentric rings or scattered over the lesions. Inoculations with spore

suspensions from pure cultures gave positive results on cabbages and cauliflowers in 1923–4, infection developing in three to six days. Under favourable conditions the spots reach a diameter of 4 to 5 mm., pycnidia appearing in 21 days and pycnospores and ascospores in about a month. When the pods are attacked the seed may become infected.

In California the perithecial stage is more abundant than the pycnidial during most of the cauliflower season, ascospores being probably responsible for the bulk of infection. They are forcibly ejected from the perithecium. Infection may also be disseminated by the seedlings, seed and pieces of the seed pods found with it, leaves, and possibly through the soil.

The fungus enters the host through the stomata. Leaves with 300 or fewer stomata per sq. mm. of surface are susceptible, while those with a greater number are resistant; but this is thought to mean merely that by the time the leaves have grown to such a size that the stomata are less densely crowded some physiological change occurs which renders them susceptible. The optimum temperature for spore germination and mycelial growth lies between 15° and 22° C., some growth being made at 0°, while death occurs in four days at 32° to 33°. The best growth was made on beef and potato agars with the addition of 1 to 2 per cent. dextrose, and on cooked cauliflower leaves.

Cold storage tests indicate that the spots do not spread rapidly enough to constitute a serious factor in deterioration in transit.

Control measures based on the production of healthy plants by seed-bed sanitation and seed treatment are thought to be more promising under the agricultural system practised in Oregon than near San Francisco. The seed should be immersed in water for ten minutes at 55° or for 30 minutes at 50°. Spraying and dusting were not only proved to be ineffective but actually injurious to the plants. None of the cauliflower and broccoli varieties tested was found more resistant than those grown commercially. Careful selection for hardiness, together with selection of comparatively healthy plants for seed and the adoption of good horticultural practices, appear to hold out the best prospect of control.

CARSNER (E.). **Seasonal and regional variations in curly-top of Sugar Beets.**—*Science*, N.S., lxiii, 1625, pp. 213–214, 1926.

Observations made during 1925 revealed marked contrasts between different localities in the incidence of curly top of sugar beets [see this *Review*, v, p. 272]. In southern California (Salinas and Sacramento Valleys) the disease was more prevalent than at any time for the past eight years. On the other hand, the intermountain region of the north-west suffered considerably less than usual. Thus in southern Idaho, where over 10,000 acres were destroyed in 1924, the 1925 crop was in excellent condition; this was probably correlated with the virtual absence of beet leafhoppers [*Eutettix tenella*] up to 1st July. Similar conditions prevailed in Utah.

These data, considered in conjunction with the meteorological records for the period from 1923 to 1925, indicate that the climatic conditions of a given area play an important part in the prevalence

of the leafhoppers and consequently of curly top. The relatively mild winter and low rainfall of 1923–4 in the north-western regions resulted in the survival of large numbers of insects, which were forced by the drought to seek vegetation early in the spring, while the severe weather in 1924–5 killed all but a small proportion. In the latter year the high and protracted rainfall in the natural (desert) breeding grounds of the leafhoppers further delayed their migration into the cultivated areas.

In the lower part of California (comprising the principal natural breeding grounds of the insect in the State), both the seasons in question were mild and comparatively dry, and both (particularly 1925) were characterized by severe outbreaks of curly top.

CARSNER (E.). **Resistance in Sugar Beets to curly top.**—Abs. in *Phytopath.*, xvi, 1, pp. 87–88, 1926.

The results of exposing a large number of strains of sugar beet apparently resistant to curly top [see this *Review*, v, p. 75], as well as sixteen strains selected purely for desirable agricultural characters, to a rigorous test in a locality infested by leafhoppers (*Eutettix tenella*) indicated that among the latter group some were more susceptible than the controls (commercial seed) and others (one in particular) less so. Several of the strains selected for resistance were definitely less susceptible than the controls—one conspicuously so. A comparatively large planting of the F_1 progeny of a mass selection for resistance also suffered less from the disease than the commercial parent. The development of a resistant commercial variety would appear from these and previous results to be feasible.

LINFORD (M. B.). **A wilt disease of Peas in Wisconsin.**—Abs. in *Phytopath.*, xvi, 1, p. 75, 1926.

During 1924–5 a wilt disease of canning peas caused losses second only to those due to root rot (*Aphanomyces*) [*euteiches*: see this *Review*, v, p. 69]. The symptoms include early and rapid wilting of the foliage, with or without previous yellowing; frequent but not constant vascular discoloration; and infection of the vessels of the tap root and lower internodes by three undetermined species of *Fusarium*, one of which has given proof of pathogenicity. The disease develops characteristically in roughly circular patches, and is most destructive in fields where peas have been grown for several years in succession. The Green Admiral variety appears to be resistant.

BENLLOCH (M.) & DEL CAÑIZO (J.): **La enfermedad de las Alubias en Barco de Ávila (Fusariosis).** [Disease of French Beans in Barco de Ávila (Fusariose).]—*Boletín de la Estación de Patología Vegetal* [Madrid], i, 1, pp. 1–7, 5 figs., 1926.

This article is the first in the new quarterly Bulletin of the Central Station of Vegetable Pathology, Madrid, a publication intended to make known the work in progress at this Station dealing with diseases and pests of cultivated plants and the means of their control, and also including information from other sources of interest.

The root disease of French beans [*Phaseolus vulgaris*] attributed to *Fusarium martii phaseoli* [see this *Review*, iii, p. 566 and next abstract] is stated to have caused considerable damage in Barco de Ávila. Visible symptoms are not apparent u`til late in the season (August to September), when the leaves droop and the plant dies off in a very short time. At this stage the entire root system, and frequently also the base of the stem, may be invaded, showing a dark red colour either uniformly over the whole surface or in streaks. Decay sets in later, and the roots may then be attacked by other fungi and bacteria. The microscopic characters of the fungus are briefly described.

A summary is given of methods recommended for the control of the disease. These are chiefly preventive, and include early sowing; rotation of crops; the application of lime and farmyard manure with basic slag, superphosphate, or kainit; the growing of resistant varieties; and the burning of diseased plants.

WEIMER (J. L.) & HARTER (L. L.). **Root rot of the Bean in California caused by Fusarium martii phaseoli Burk. and F. aduncisporum n. sp.**—*Journ. Agric. Res.*, xxxii, 4, pp. 311–319, 3 pl., 1926.

All commercially cultivated varieties of beans (*Phaseolus vulgaris*) and sometimes also the cowpea (*Vigna sinensis*) throughout California are stated to suffer severely from a root rot which, in many cases, affects almost the whole crop. Although in the early stages of their development diseased plants usually do not show any pathological symptoms, in some instances symptoms appear very early in the seedlings, and suggest that the latter may have been infected from the start. At a later stage, however, the plants are distinctly stunted and more or less yellowed. They may eventually die, but usually death supervenes very slowly, the majority of the infected plants living throughout the growing season, though producing little or no seed. The diseased roots commonly show a more or less uniform reddish discoloration of the greater part of the taproot, sometimes extending slightly above ground and along the larger fibrous roots. At first little decay is evident, but as the disease advances the fibrous roots and the lower part of the taproot shrivel and finally become dry. There are indications that the causal organism may gain entrance into the root tissues either directly through the epidermis or through wounds.

Isolations from the diseased roots of several varieties of beans and the Blackeye cowpea, combined with artificial inoculation experiments, showed that two species of *Fusarium* are involved in the bean disease, one of which was identified with *F. martii phaseoli*, while the other appears to be a hitherto undescribed species for which the name *F. aduncisporum* is proposed. In the latter, microconidia are not common. The macroconidia, 30 to 60 by 4·5 to 5·5 μ (average 48·3 by 5·3 μ), typically 0- to 3-septate (septations frequently not readily visible), are of approximately uniform diameter throughout their length or slightly tapering towards one or both ends, and distinctly curved; one end, rarely both, may be bent inward, becoming more or less hook-shaped, and this forms a characteristic morphological feature of the species. The chlamydo-

spores are mostly intercalary, borne singly or in short chains, not common on most media, and 5 to 12 μ in diameter. The aerial mycelium is poorly developed in culture and usually white.

The cultural characters of both species on certain media were very similar, while on other media they differed widely. In general, *F. martii phaseoli* produced more zinc-green and dusky-greenish-blue pigment, while *F. aduncisporum* formed more cinnamon-brown to clay pigment.

Artificial inoculation experiments, some details of which are given, showed that both species are about equally parasitic on Lima beans [*Phaseolus lunatus*] and cowpeas. *F. aduncisporum* gave 100 per cent. of infection when a spore suspension was poured on the base of young plants of Davis White Wax beans [*Phaseolus vulgaris*].

Fusarium tracheiphilum was isolated from Blackeye cowpeas affected by a similar disease on one occasion, and its parasitism demonstrated.

HEDGES (FLORENCE). **Bacterial wilt of Beans (Bacterium flaccumfaciens Hedges), including comparisons with Bacterium phaseoli.**—*Phytopath.*, xvi, 1, pp. 1–22, 3 pl., 1926.

A description is given of the bacterial wilt of beans caused by *Bacterium flaccumfaciens* [see this *Review*, iii, p. 117], which is known to occur in South Dakota, Maryland, Michigan, Montana, and Virginia, and has also been isolated from seed from France and Germany.

On Navy beans (the variety which has been principally studied in this connexion), the wilting and shrivelling of seedlings two or three inches high is sometimes accompanied by a dull green or brownish-green discoloration, and the plants may be killed before developing more than the first pair of leaves. Older diseased plants are conspicuous, in the later stages, by their large number of shrivelled leaves, but the early symptoms are not very noticeable. The discoloured areas are flabby at first, then dry and papery; occasionally the greenish- or reddish-brown areas have yellow borders. The leaf blades and petioles may droop without any other signs of infection, while the breaking over of diseased plants at the nodes may also be observed. On the pods a yellowish-green to olive discoloration runs along one or both sutures and sometimes spreads laterally. Infected pods have been found on large, vigorous plants showing no other sign of disease.

There are two types of seed infection: (1) systemic or internal, and (2) superficial. Seeds affected by the first type are coloured bright yellow by the thick bacterial layer under the white seed-coat, while those which are superficially infected show only a small quantity of yellow slime at the hilum. Germination appears to be only slightly impaired by infection with *Bact. flaccumfaciens*. In the writer's opinion much of the systemic infection usually attributed to bean blight (*Bact. phaseoli*) [see this *Review*, v, p. 203] is really due to *Bact. flaccumfaciens*.

The disease has been observed occurring naturally on Navy and Wax beans [*Phaseolus vulgaris*], and also on Lima beans [*Phaseolus

lunatus], while artificial infection has been produced on Ito San soy-beans [*Glycine soja*].

The causal organism has been isolated and infection repeatedly secured by prick inoculations with subcultures from single colonies. The stomatal infections common in bean blight do not occur.

A technical description of *Bact. flaccumfaciens* and a detailed account of its cultural characters are given. The rod-shaped organism measures 0·6 to 3 by 0·3 to 0·5 μ and occurs singly or in pairs; it is pale cream to yellow in colour, motile by a single polar flagellum three or four times its own length, Gram-positive, non-acid-fast, and liquefies gelatine slowly. The minimum temperature for growth is below 1·5°, optimum 31°, and maximum between 36° and 40° C.

Some comparisons are drawn between *Bact. flaccumfaciens* and *Bact. phaseoli* and a table of cultural tests for the differentiation of the two organisms is given.

Observations and experiments have shown that the disease is transmitted through the seed, in which the organism has been known to remain alive and virulent for five years. The use of clean seed from healthy fields is the most promising control measure known at present. The use of bean straw as a fertilizer or for fodder should be avoided. Experiments on seed treatment and soil infection by *Bact. flaccumfaciens* are in progress.

WALKER (J. C.) & WELLMAN (F. L.). **Relation of temperature to spore germination and growth of Urocystis cepulae.**—*Journ. Agric. Res.*, xxxii, 2, pp. 133–146, 1 fig., 3 graphs, 1926.

Previous studies have shown [see this *Review*, i, p. 281] that abundant infection by onion smut (*Urocystis cepulae*) occurs at soil temperatures as low as 10° to 12° C., which is nearly as low as will permit the germination and growth of onions. Infection occurs equally well up to 25°, above which point there is a rapid reduction, while at 29° or over the plants remain free from the disease.

The main purpose of the present study was to determine whether this temperature inhibition is the result of the direct effect of the temperature on the parasite, of host response to temperature, or of the combined effect of both.

The minimum temperature for the germination and growth of *U. cepulae* was found to be very close to that of the onion plant. The optima for chlamydospore germination, hyphal fragment germination, and vegetative growth of the thallus lie between 13° and 22°. Above 25° germination is decidedly reduced and hyphal growth becomes sparser with the rise in temperature.

No appreciable change was observed in the rate of growth or duration of susceptibility of the host when grown slightly above or below the critical point (29°). The marked inhibitive effects of temperatures above 25° upon the parasite, with the maximum lying only just above 29°, show that the direct influence of temperature on the fungus is a primary factor in the limitation of infection.

Although the smut fungus is continually being distributed throughout the States on northern-grown onion setts, the disease has not yet been recorded in the extensive southern onion-growing regions, whereas it has become established in the cooler northern

areas of America as well as of Europe. The results of this study confirm the theory previously advanced [loc. cit.], namely, that temperature is one of the most important factors in the regional limitation of the disease.

LINK (G. K. K.) & BAILEY (ALICE A.). **Fusaria causing bulb rot of Onions.**—Abs. in *Phytopath.*, xvi, 1, pp. 74–75, 1926.

Two hundred isolations of *Fusarium* species have been made from onion bulbs and the pathogenicity of half the cultures tested. The species which are invariably pathogenic belong to the *elegans* section. The following have been determined: *F. zonatum* Sh. forma I Wr. (*F. cepae* Hanz. emend. Walker & Tims); *F. zonatum* Sh. forma II; and *F. cepae* Hanz. emend. Link & Bailey. One member of section *liseola*, *F. moniliforme* [*Gibberella moniliformis*], isolated from decaying bulbs, was pathogenic only in about 50 per cent. of the cases examined. The lesions vary from a mealy, vinaceous buff to a powdery, dry, avellaneous to cinnamon rot. Some species of *Fusarium*, not invariably pathogenic, when associated with bacteria, cause a decay resembling that produced by the truly pathogenic species in the presence of bacteria. Among these are *F. bulbigenum*, *F. oxysporum*, and *F. vasinfectum* (section *elegans*), and *F. martii* var. *minus* (section *martiella*).

BRYAN (MARY K.). **Bacterial leafspot on Hubbard Squash.**—*Science*, N.S., lxiii, 1623, p. 165, 1926.

In August, 1925, leaves of Hubbard squash [*Cucurbita maxima*] were received from New York with angular spots closely resembling those due to *Bacterium lacrymans*. Isolations, however, yielded an entirely different organism, which is described as a Gram-negative, polar flagellate rod, commonly with one flagellum. Colonies on peptone beef agar at P_H 7·0 are convex and wax yellow, with internal concentric markings by oblique light. Gelatine is slowly liquefied; nitrates are not reduced; and litmus milk is peptonized but without change of colour. In beef broth a heavy yellow rim is formed and often (in undisturbed cultures) a pellicle, both composed of coarse pseudozoogloeal masses. Growth on potato cylinders is very abundant, destroying the starch and filling the water with dense yellow slime.

The name *Bact. cucurbitae* n. sp. is suggested for this organism, inoculations with which produced infection on squash leaves.

DRECHSLER (C.). **The cottony leak of Eggplant fruit caused by Pythium aphanidermatum.**—*Phytopath.*, xvi, 1, pp. 47–49, 1 pl., 1926.

Strains of *Pythium aphanidermatum* isolated from cucumbers affected by cottony leak [see this *Review*, v, p. 71] produced a rapid decay in inoculated eggplants (*Solanum melongena*), and at Knoxville, Tennessee, this fungus was reported to have caused a loss of 1 per cent. of the crop in 1923. In 1925 a decay of eggplant fruits similar to that resulting from artificial inoculation with *P. aphani-*

dermatum was observed at Bradentown, Florida. Eighteen pure cultures of the fungus were obtained, and found to agree closely with the characteristic morphology of the species. Cucumbers inoculated with these strains developed the typical softening of the tissues and abundance of extramatrical mycelium associated with cottony leak.

The decay of eggplants caused by *P. aphanidermatum* is stated to be unusually rapid, complete destruction of the fruit occurring in 78 hours after inoculation. The affected region assumes a tan coloration somewhat similar to that produced by *Phomopsis vexans*. The epidermis becomes minutely wrinkled and rubs off from the underlying tissue on very slight friction. Internally the advance of the parasite is marked by a dark sepia-brown discoloration and a pronounced softening of the texture of affected parts. In advanced stages of the disease a brownish liquid generally exudes in quantity.

The disease, which is believed to have been generally attributed to *P. vexans* on account of the similarity of the lesions, appears to be confined to poorly drained soil, and is therefore more likely to be serious in the northern latitudes, where the rainfall from July to September is fairly heavy, than in Florida.

A species of *Pythium* of the *de Baryanum* type was isolated from one eggplant fruit and inoculated into healthy individuals with positive results. Its effect on the tissues was similar to that of *P. aphanidermatum*, but the rate of destruction was only about half as rapid, and the production of aerial mycelium relatively meagre. As in the case of cottony leak of cucumbers, the capacity of the extramatrical mycelium to penetrate the unwounded external tissues of the host, rather than a superior degree of virulence, is responsible for the predominance of *P. aphanidermatum* in naturally infected eggplants.

La verruga de la Viña [Crown gall of the Vine.]—*Min. Agric. Nac.* (*Buenos Aires*), *Secc. Prop. e Inform. Circ.* 565, 3 pp., 1 fig., 1926.

A popular account is given of the general distribution, symptoms, causes, varieties attacked, and control of the so-called 'verruga' disease of the vine, which is stated to be the same disease as that known as 'rogna' and 'malatía dei tobércoli' [= *tubercolosi della vite*] in Italy, as 'krebs' and 'schorf' in Germany, as 'broussins' in France, and as black knot, crown knot, and cane knot in the United States. In the Argentine the disease is especially prevalent in Mendoza, San Juan, and Catamarca.

Italian and American investigations are stated to have demonstrated that this disease is caused by the crown gall organism, *Bacterium tumefaciens*.

The disease causes a thick, gnarled malformation on the vine stems. It is more frequent on surface-irrigated vineyards, and ridge irrigation is therefore advocated. The following varieties are stated to have proved highly resistant to attack: Rupestris San Jorge, Riparia (grafted), Feher Szagos, Chasselas Dorado, Sultana, Carignan, Garnacha, Gros Colman, Mataró, Malvasía negra, Burger, and Lenoir.

Faes (H.) & Staehelin (M.). **Le rougeot ou rougeau** [Rougeot or rougeau.]—*Annuaire Agric. de la Suisse*, xxvii, 1, pp. 109–121, 1 col. pl., 1 fig., 1926.

The condition known as 'rougeot' or 'rougeau' is, in France, generally associated with physiological disturbances or soil or climatic influences [see this *Review*, iv, p. 143]. The authors draw attention to the fact that the form observed in Swiss vineyards, is, however, of a purely parasitic nature, and is due to the fungus *Pseudopeziza tracheiphila*. Certain distinctive features between the two types are indicated. The parasitic 'rougeot' (known also as 'roter brenner') affects the vine as early as June, is confined exclusively to the leaves at the base of the shoots, and does not cause the leaf margins to curl downwards. At the time of the vintage the affected leaves have already fallen. The disease is endemic, and is always more prevalent on steep and stony areas or on compact clay soils. The non-parasitic form observed in France appears, on the contrary, later in the year; the affected leaves remain attached to the branches longer than the normal foliage, and their margins curve downwards. This form of 'rougeot' is found frequently on low-lying land and on heavy, badly drained soils.

In 1924 the parasitic form developed to an exceptional extent in several Swiss, French, and Luxembourg vineyards on account of the favourable conditions for the disease in the spring of that year. Several direct hybrid producers [not grafted] and also some American vine-stocks were severely affected.

Satisfactory results in the control of the parasitic rougeot were obtained at Yvorne, Switzerland, in 1924, by repeated applications of Bordeaux mixture, commencing from the time the shoots measured 5 cm. in length.

Bonnet (L. O.). **A promising remedy for black measles of the Vine.**—*California Agric. Exper. Stat. Circ.* 303, 10 pp., 5 figs., 1926.

Black measles of the vine [see this *Review*, ii, p. 438] would appear from the writer's observations and experiments to be identical with the disease known in Europe as apoplexy [variously attributed to *Fomes igniarius*, *Stereum hirsutum*, or *S. necator*: see this *Review*, iii, p. 315, and next abstract], and also to be amenable to the arsenical spray which has given such excellent control in France and Algeria. In over forty cases examined in California, a mass of soft, spongy, yellowish, decayed wood was found in the crown of the trunk. Complete control was secured in five trials by the application, during the dormant period (15th December to end of March), of sodium arsenite 2–50 or 3–50 or a solution consisting of $2\frac{1}{4}$ lb. white arsenic (arsenic trioxide), $4\frac{1}{2}$ lb. washing soda, and 50 galls. of water. The mixtures may be applied either by a swab in small vineyards or by spraying with a pressure pump where treatment on a large scale is necessary. Another efficacious formula is $2\frac{1}{4}$ lb. white arsenic, $1\frac{1}{8}$ lb. soda lye, and 50 galls. water. Directions for preparation are given.

Gard (M.). **Le traitement de l'apoplexie de la Vigne.** [Control of apoplexy of the Vine.]—*Rev. de Vitic.*, lxiv, 1649, pp. 84–85, 1926.

This is a progress report of the experiments made by the author in 1925 in continuation of his work on apoplexy of the vine [see this *Review*, iii, p. 630]. The results indicated that the arsenical solutions recommended for the control of the disease should be applied to the whole stocks, and not sprayed only on the pruning wounds. Preliminary stripping of the old bark from the stocks is not recommended, as the bark imbibes the solution and helps towards its progressive penetration into the incipient cracks in the wood. Spraying the soil around the stocks with the arsenical solutions was found to have no controlling effect on the disease.

[In the same number of the *Revue* is published a coloured plate showing the fructifications of the fungus to which the 'esca' disease (apoplexy) is ascribed. This fungus is stated to be *Stereum necator*, a detailed account of which by P. Viala is in course of publication.]

C. (A.). **Actualités.—A quelle époque doit-on se préserver et lutter contre l'anthracnose?** [Current events.—At what season of the year should preventive and control measures be applied against anthracnose?]—*Rev. de Vitic.*, lxiv, 1650, pp. 112–113, 1926.

After a brief description of the symptoms of anthracnose of the vine [due to *Gloeosporium ampelophagum*], in which attention is especially called to the brittleness of the affected shoots, the author recommends the following treatment. The entire stocks should be thoroughly washed during the winter or early in the spring after pruning, but not later than three weeks before the bursting of the buds, with a hot or warm acid solution of iron sulphate (30 to 40 kg. to 100 l. water, plus 1 l. sulphuric acid). This treatment should be followed by a dusting of the young shoots with a mixture of sulphur and lime; although this dusting has no great effect against anthracnose, it is useful in protecting the leaves against early outbreaks of *Oidium* [*Uncinula necator*].

Pethybridge (G. H.). **Fungus and allied diseases of crops. 1922–1924.**—*Min. Agric. Misc. Publ.* 52, 97 pp., 1926.

The Ministry of Agriculture's report on the occurrence of fungous, bacterial, and allied diseases of crops in England and Wales during 1922, 1923, and 1924 contains a considerable number of host plants and diseases not included in the preceding report [see this *Review*, ii, p. 207]. An attempt is made to indicate the intensity of attack of many diseases from one season to another. The following items of interest may be mentioned.

In the unusually wet season of 1924, late blight of potatoes (*Phytophthora infestans*) was more severe and widespread than in the two previous years. Losses were most extensive in early and second early varieties, but maincrop varieties also suffered much more than usual.

The number of new outbreaks of potato wart disease (*Synchytrium endobioticum*) was slightly higher in 1922 than in 1921,

when it was conspicuous by its absence. Since 1922 a progressive decline is shown in the number of parishes in which the disease was recorded for the first time, the numbers falling from 44 in 1922, to 13 in 1923, and 11 in 1924. With one exception, the new records occurred in districts adjoining the main infected area. With reference to the Wart Disease of Potatoes Order of 1923 [see this *Review*, ii, p. 591] it is stated that during 1923 some 61,000 acres of potatoes, and in 1924 an additional 3,000 acres, were certified as free from attack.

Powdery scab (*Spongospora subterranea*) was very prevalent in 1924, and in some cases the potato crop was entirely destroyed. The attacks were most severe in the north and midlands of England, and in Wales, especially on allotments where rotation had been neglected. Pink rot (*Phytophthora erythroseptica*), first reported in England in 1921, was recorded in two counties in 1922, in three in 1923, and in two in 1924. The disease was in every case sporadic and not of serious economic importance. Attention is drawn to the occurrence of this fungus on deadly nightshade (*Atropa belladonna*) in Holland. A dry rot of potato associated with a species of *Phoma* (? *P. tuberosa*) was reported for the first time in England in 1923 from Yorkshire and Carnarvonshire. It occurred in the complete absence of *Spongospora*, unlike the reports of *P. tuberosa* in the United States. Black dot or dartrose (*Colletotrichum tabificum*) [*C. atramentarium*: see this *Review*, v, p. 447] was reported for the first time from five different counties, occurring almost entirely on dead haulms. It is regarded as uncertain whether the fungus is really parasitic on the potato.

A leaf spot apparently caused by *Cercospora bloxami* was observed in 1924 as common on the older leaves of swede turnips in Devon.

Chocolate spot (*Bacillus lathyri*) was prevalent on beans in 1922, especially on winter beans in the southern counties. In 1923 and 1924 it was generally distributed and the attacks often severe. The organism was also isolated from soy-beans. The stripe disease of peas attributed to *Pseudomonas seminum* occurred in Essex, and caused severe damage in allotments in Yorkshire. Two cases of the recently described root rot of peas due to *Aphanomyces euteiches* [see this *Review*, v, p. 201] were reported from Stafford and Cardigan.

Anthracnose (*Gloeosporium caulivorum*) [see this *Review*, iii, p. 401] caused serious damage to New Zealand and Chilian strains of red clover in Wales in 1922. In Kent certain strains showed marked resistance.

Amongst vegetable diseases; the leaf spot caused by *Gloeosporium concentricum* on Brassicae, especially broccoli, is thought to be not always distinguished from that due to *Mycosphaerella brassicicola*, and may, therefore, be commoner than the records would imply. A root rot of celery caused by *Phoma apiicola* was reported in 1924 for the first time in England, where it has evidently been overlooked in the past. No fresh cases of onion smut (*Urocystis cepulae*) were reported in 1922 and 1923, but in 1924 infection occurred in five contiguous market gardens in Northumberland and a further case in Suffolk. It has now been recorded in five different

counties, and administrative measures have been taken in each case to suppress the disease and prevent its spread.

The occurrence of black rot canker of the apple (*Physalospora cydoniae*) was not recorded during 1922 and 1923, although it has been undoubtedly present in the country for many years. In 1924 the pycnidial stage of the fungus was found in Cornwall. A well-defined circular leaf spot, probably of bacterial origin, occurred on Cox's Orange and, to a less extent, on Bramley's Seedling and Grenadier apples; the resulting damage was small, but slight premature defoliation was noted in some instances. Fruit spotting and rot due to *Coniothecium chomatosporum* was severe in 1923 on cider apples at Hereford, causing cracking of the fruit; it was also noted near Reading. A species of *Phyllosticta*, associated with severe fruit spotting, was reported in 1924 from Lancashire and three districts in the Midlands.

Blossom bacillus *Pseudomonas* [*barkeri* Berridge: see *Ann. Appl. Biol.*, xi, p. 74, 1924] of pear was reported in 1924 on fifteen-year-old bush trees on quince stock. In addition to wilting of blossom trusses, the wood was attacked in some cases, the cortex being killed, and canker-like injuries and cracking of the old wood being caused. *Coniothecium chomatosporum* caused cracking of pear fruit in Kent.

Silver leaf (*Stereum purpureum*) has been very prevalent in some important plum-growing districts; as many as 2,000 trees were destroyed within five years on commercial plantations of 230 acres in one area. It has been estimated that over 50 per cent. of the Victoria plum trees planted during the past 10 to 20 years are now dead or dying from silver leaf. A serious attack of witches' brooms (*Exoascus* [*Taphrina*] *insititiae*) occurred on Damascene plums in the Evesham district (Worcestershire).

A case of apparent mosaic in gooseberry was reported from Cheshire. The diseases variously known as red plant, red leg, and patch [see this *Review*, iii, p. 281] have caused severe and increasing damage to strawberries. Fig canker (*Phomopsis cinerascens*) continues to cause serious trouble in the Worthing district of Sussex.

MANNS (T. F.) & ADAMS (J. F.). **Department of Plant Pathology.** —*Ann. Rept. Delaware Agric. Exper. Stat. for the fiscal year ending June 30, 1925* (*Bull.* 141), pp. 24–30, 1 fig., 1925. [Received May, 1926.]

Further studies on the identity of the causal organism of pox of sweet potatoes confirmed the results obtained in the previous year [see this *Review*, iv, p. 466]. The species of *Actinomyces* responsible for the disease is identified as *A. poolensis* Taub. [see this *Review*, iii, p. 19], which acts chiefly by crippling or 'eating off' the small roots. During dry spells the stand may be completely destroyed in this way. The organism was isolated from pox lesions on a 1·2 per cent. agar medium without nutrients, and successful infections were produced through soil inoculations both with the recent isolations and with the original strain of *A. poolensis*. The results of field observations indicate that soil reactions above P_H 6 throughout the growing season increase the incidence of infection and reduce the yield.

Further investigations were carried out on the value of inoculated sulphur in the control of pox and of black rot [*Ceratostomella fimbriata*]. The results of three years' work show that adequate applications of inoculated sulphur have been consistently associated with brighter and cleaner sweet potatoes at harvest time. A high percentage of first grade potatoes is generally given by sulphur-treated plots, and there is some evidence of improvement in keeping quality, especially as regards black rot. Used as a fungicide, inoculated sulphur has practically controlled soil stain [*Monilochaetes infuscans*: see this *Review*, iv, p. 119; v, p. 383] and pox, and materially reduced black rot. Applied at the rate of 300 to 400 lb. per acre no bad effects on succeeding crops were observed.

A species of *Pythium* was found in the root system of sweet potatoes, but it is doubtful whether the disease caused by this fungus is of any economic importance in Delaware.

It was again found impossible to produce the symptoms of yellows and little peach by injecting infusions of the tissues into healthy trees. Owing to mechanical difficulties investigations on the curculio [*Conotrachelus nenuphar*] as a possible carrier have so far proved fruitless, but they will be continued in a modified form.

Initial infection by *Bacterium pruni* on peaches [see this *Review*, iv, pp. 616, 617] was observed on 14th May and the first wave of defoliation occurred on the first two or three leaves during the following week. Fruit infection was noticed on 15th May, and on the same date lesions were found at the base of the new growth, cultures from which gave a yellow organism resembling *Bact. pruni*. The results of inoculation experiments with pure cultures of *Alternaria brassicae* on cantaloupes and water-melons were negative. It is concluded that *A. brassicae* var. *nigrescens* is in no way related to the causal organism of leaf spot, namely, *Macrosporium cucumerinum*, as is often stated [see this *Review*, iv, p. 362].

Two diseases of soy-beans not previously reported from Delaware were observed, namely, a leaf spot caused by (?) *Septoria glycines* and the downy mildew (*Peronospora sojae*). The former was confined to the seed leaves, suggesting internal infection of the seed. Leaf spot due to *Bacillus* [*Bacterium*] *phaseoli sojense* [see this *Review*, iv, p. 329] was a limiting factor in the 1924 crop.

Two years' comparisons of dust versus liquid fungicides for the control of apple scab [*Venturia inaequalis*] have shown that the former are practically equal to the latter in efficacy if started subsequent to the cluster bud (pink) stage.

Black rot [*Guignardia bidwellii*] was the most active rot on Concord grapes, which were also attacked by ripe rot or anthracnose (*Sphaceloma ampelinum*, formerly known as *Gloeosporium ampelophagum*) [see this *Review*, iv, p. 139] and bitter rot (*Melanconium fuligineum*). These three diseases are frequently carried over on the first few internodes of the same vine. Dead arm (*Cryptosporella viticola*) and *Pestalozzia uvicola* were also observed. It has repeatedly been shown that the source of these diseases, namely, the 'carry-over' on the new growth, can only be controlled by timely spraying [see also this *Review*, iv, p. 467]. The first application should be given when the new growth does not exceed $\frac{1}{2}$ to $\frac{3}{4}$ inch in length; the second when it attains a length of four to six inches

the third (and most important) when 10 to 20 per cent. of the blossoms have broken; the fourth when 90 per cent. have completed blossoming; and the fifth when the grapes are the size of peas. The last two applications should be supplemented by lead arsenate and nicotine sulphate.

The organism causing foot rot of tomatoes was also found to produce a severe early leaf blight. It is believed to be identical with that causing early blight of potatoes [*Alternaria solani*].

DURRELL (L. W.). **Report of the Botanist.**—*Thirty-eighth Ann. Rept. Colorado Agric. Exper. Stat. for the year 1925,* pp. 20–22, 1925. [Received May, 1926.]

In a study of oat smut [*Ustilago avenae*] it was found that the carbonic acid from live plant tissue or germinating seeds stimulates the germination of the spores. Similar results were obtained with the spores of various other fungi. Measurements of the surface tension of the infection drop denoted that lowered tension increases the germination of certain fungus spores.

Investigations on black stem rust [*Puccinia graminis*] showed that the uredospores remain viable throughout the winter within the leaf sheaths of wild barley under moist conditions, e. g., on the borders of lakes. Enclosure within the sheath prevents the dissemination of the spores in the spring. The disease was found to spread progressively from Oklahoma and Texas to the eastern grain section of Colorado, where barberries have been eradicated. This mode of infection is slow, however, being approximately a fortnight later in developing than that from local barberries, and in normal years the grain escapes rust.

The success of copper carbonate as a treatment for bunt [*Tilletia tritici* and *T. levis*] has recommended it for general use.

Histological studies of lucerne roots indicate that the prevalent local wilting [see this *Review*, iv, p. 401] is due to obstruction of the vascular system by a gum-like secretion.

Forty-fourth Annual Report of the Ohio Agricultural Experiment Station for 1924–25.—*Ohio Agric. Exper. Stat. Bull.* 392, 100 pp., 12 figs., 1 graph, 4 maps, 1926.

The following references of phytopathological interest, other than those already noticed in this *Review*, occur in this report.

Owing to the dry weather during the critical period for spore discharge, the incidence of apple scab [*Venturia inaequalis*] in 1925 was very slight even in untreated orchards. It was shown that initial infection may occur as soon as the buds open or even before the application of the dormant spray, such attacks subsequently giving rise to fruit infection. One block of McIntosh apples was sprayed with oil in the delayed dormant stage, and later applications were made with 300-mesh sulphur dust. At the end of the season 11·6 per cent. of the foliage showed scab. Another block was sprayed with soluble sulphur in delayed dormant and afterwards received sulphur dust applications as above. This block gave 2·5 per cent. of scabby leaves.

The best control of blotch (*Phyllosticta solitaria*) was given by Bordeaux mixture 2–2–50 (3–3–50 at midsummer), which reduced

the incidence of infection from 83·5 per cent. severely blotched and 9·2 slightly blotched to nil and 0·6 per cent., respectively. The corresponding figures for lime-sulphur 1 in 40 were 6·7 and 21·8 per cent. The efficacy of lime-sulphur appears to depend on the time of infection. When this occurs early, as in 1924, lime-sulphur is very efficient [see this *Review*, iv, p. 611], but in seasons of later infection it is less effectual. For the elimination of blotch in badly infected orchards Bordeaux mixture would seem to be preferable.

Lime-sulphur was not effective in the control of bitter rot [*Glomerella cingulata*], but copper dusts gave promising results in this respect.

Little attention has hitherto been paid to peach diseases in Ohio, with the result that the cultivation of this fruit has given very uncertain returns. A definite spraying programme, however, has now been formulated. It has been found that for the summer treatment sulphur dusts may be substituted for the liquid spray with practically equal results. An investigation is also in progress on the nature and etiology of peach cankers, which are stated to be very prevalent in Ohio. It is believed that various fungi and bacteria are more commonly associated with this type of injury than is generally supposed. The brown rot fungus (*Sclerotinia cinerea*) was found to be present in many cases, and inoculations into healthy twigs produced the typical symptoms of canker.

Black spot [bacterial spot or shot hole] of peach and plum (*Bacterium pruni*) appears to be rare in Ohio where it is often confused with peach blight or pustular spot [*Coryneum beijerinckii*] on the fruit; with the spots produced by arsenate of lead on the leaves; and with the lesions caused by various organisms on the twigs. It appeared only twice in several hundred isolations.

Four applications (fortnightly from the end of June) of copper-lime dust produced a greater increase in the potato yield than either 4–6–50 or 5–7–50 Bordeaux mixture (278·2 bushels compared with 265·9 and 264·9, respectively). In the control plot the yield amounted to 212·1 bushels. In 1924, however, the increase due to dusting was only 44·6 per cent. as great as that from liquid Bordeaux. The inconsistent results of these and other tests leave the value of dusting potatoes somewhat doubtful.

In experiments with potato mosaic it was found that both diseased and healthy plants might result from different tubers of the same hill and even from different eyes of the same tuber, thereby proving that the virus of degeneration diseases may not be present in every tuber or in every eye of a tuber. Hills affected with leaf roll, one of the main causes of running out in Ohio, were found to yield only 38·9 per cent. as much as healthy hills. Mild mosaic [see this *Review*, v, p. 318], which has only occasionally been detected in Ohio, reduced the yield to 90·8 per cent. of that of healthy hills, while severe or rugose mosaic diminished the yield to 33·1 per cent. of that of healthy hills.

The most promising selection of early cabbage resistant to yellows [*Fusarium conglutinans*] was made in 1922 from a planting of Burpee's Early Forcing. In 1925 the plots of this variety showed less than 2 per cent. infection in diseased soil.

ROBBINS (W. J.). **Botany.**—[*ex* 'Some new developments in agricultural science: one year's work, Agricultural Experiment Station (Report of the Director; July 1, 1924, to June 30, 1925)'.]—*Missouri Agric. Exper. Stat. Bull.* 236, pp. 44–45, 1926.

Additional experiments were conducted by I. T. Scott on the possibility of adjusting the reaction of field soils to a hydrogen-ion concentration unfavourable for the growth of the tomato wilt organism (*Fusarium lycopersici*) [see this *Review*, iv, p. 719]. Water-slaked lime was thoroughly incorporated into the upper 8 to 9 inches of soil at the rates of 6,000 and 8,000 lb. per acre, powdered sulphur being similarly applied to other plots at 400 and 600 lb. per acre. The initial reaction of the soil was P_H 5·2 to 5·3. After 40 days the average reaction in the plots receiving lime was P_H 7·37 and 7·62, respectively, and that of those to which sulphur was applied, P_H 5·05 and 4·9, respectively. Seedlings of the susceptible Livingston's Early Stone variety were then planted after inoculation of the roots with a spore suspension of *F. lycopersici*. There was a marked difference in the rate of development and intensity of the infection in the various plots. While 70·2 to 74·2 per cent. of wilt eventually developed (after 71 days) on the limed plots, most of the fruit gathered from the affected plants (which in some cases showed very slight symptoms) was of good marketable quality. The control plants and those in the sulphur-treated plots were severely wilted.

For several years a blight of lucerne, consistently associated with a species of *Fusarium*, has been increasing in Missouri. Isolations from diseased plants grown in widely separated localities have yielded an apparently identical organism.

Several selected strains of wheat showed considerable promise in their relative resistance to infection by scab (*Gibberella saubinetii*). Prominent among these were Michigan Wonder, Poole C. I. 5353, Pride of Indiana, Red Cross, and three strains of Red May, all of which showed under 1 per cent. infection, compared with 11 per cent. in the control plots. Greater susceptibility was shown by the Turkey-Kanred and Mediterranean groups.

A new fruit spot of apple, apparently restricted to the King David variety, was investigated by I. T. Scott. Circular, dark brown to black, slightly depressed spots, 2 to 8 mm. in diameter, centring round a lenticel, appeared during the late summer on ripening fruit. The lesions, which were more abundant on the side of the fruit exposed to the sun, only penetrated 4 to 5 mm. into the fruit. The disease is believed to be of physiological origin.

BUCHHOLZ (A. B.). **Plant diseases in 1925.**—*Proc. New York State Hort. Soc.*, lxxi, pp. 18–23, 1926.

Apple root rot [see below, p. 498] appears to be causing increasing damage in western New York, some Baldwin orchards having lost 15 to 20 per cent. of the trees.

The so-called 'Stevens' or 'cork' disease, characterized by the development of large corky areas under the surface of the apple, was prevalent in the Champlain region.

Fireblight [*Bacillus amylovorus*] was severe on young trees of

Alexander, Spitzenburg, King, and Twenty Ounce apples. This disease was also the chief cause of injury to pears.

Peach yellows [see this *Review*, iv, p. 294] continues to cause damage where the removal of infected individuals is neglected.

Peach leaf curl [*Taphrina deformans*] was controlled by the application of 1 in 8 lime-sulphur, while dusting with copper carbonate proved ineffectual.

Bacterial blight [*Bacterium phaseoli*], dry root rot [*Fusarium martii phaseoli*: see above, p. 462], and anthracnose [*Colletotrichum lindemuthianum*] were all responsible for heavy damage to beans, the first-named being probably more severe than in any season during the past ten years.

In one locality of the Hudson Valley, several tomato fields were destroyed by the Grand Rapids disease (*Aplanobacter michiganense*) [see this *Review*, ii, p. 347].

ULTÉE (A. J.). **Verslag over de werkzaamheden van het Proefstation Malang in het jaar 1925.** [Report on the work of the Malang Experiment Station in the year 1925.]—*Meded. Proefstat. Malang*, 57, 52 pp., [1926].

The following scattered references of phytopathological interest occur in this report. *Crotalaria anagyroides* growing on damp soil at a high altitude was attacked by pink disease [*Corticium salmonicolor*], and in one case by the grey dadap fungus (*Septobasidium bogoriense*) [see this *Review*, ii, p. 145], the latter reported for the first time from the Malang district.

The work of eradication of *Fomes* [? *lignosus*] in rubber plantations, the scope of which was indicated in the previous year's report [see this *Review*, iv, p. 596], was on the whole successful. During the 1925 operations, covering a period of nine months, 25 per cent. of the trees in a severely infected plantation were found to be attacked: of the diseased individuals 29 per cent. were destroyed and the remaining 71 per cent. saved, at any rate temporarily, by appropriate treatment.

Mildew (*Oidium* sp.) [*O. heveae*] was prevalent as a result of the protracted drought, the trees on certain estates losing their young leaves two or three times in succession. Towards the end of September the incidence of infection declined although the dry weather persisted.

Stripe canker [*Phytophthora* sp.] mostly occurs in rubber plantations densely interplanted with coffee.

A die-back of Excelsa coffee, which later spread to the adjacent Robusta plantations, was characterized by the yellow discoloration of the youngest leaves and the desiccation of the terminal bud of a lateral branch, followed by the death of the latter. Sections through diseased branches reveal a dull discoloration of the wood. The cause of the disease, which is believed to be infectious, is still obscure.

FEJGIN (B.), EPSTEIN (T.), & FUNK (C.). **Sur trois souches de bactéries isolées des tumeurs malignes.** [On three strains of bacteria isolated from malign tumours.]—*Comptes rendus Soc. de Biol.*, xciv, 3, pp. 199–201, 1926.

From tumours in rats produced by the ninth and twelfth sub-

culture, respectively, of the bacterial strain L (originally isolated by Blumenthal and his collaborators) [see this *Review*, iv, p. 727], the writers have obtained two strains, FF and T. A further strain, MK, was isolated from a uterine carcinoma. The cultural and biological characters of the three strains are described. They differ from *Bacterium tumefaciens* in their biochemical reactions, but closely resemble it from the serological standpoint. Thus rabbit serum immunized with *Bact. tumefaciens* agglutinates the strains FF, T, and MK, and vice versa. Hitherto the results of inoculations with these strains have been negative in rats but positive in plants [see next abstract].

FEJGIN (B.), EPSTEIN (T.), & FUNK (C.). **Sur une tumeur végétale provoquée par une bactérie isolée d'un carcinome humain.** [On a plant tumour induced by a bacterium isolated from a human carcinoma.]—*Comptes rendus Soc. de Biol.*, xciv, 14, pp. 1097–1098, 1926.

On 15th June, 1925, seven plants of *Pelargonium zonatum* were inoculated with the bacterial strain MK isolated from a uterine carcinoma [see preceding abstract]. Three months later one of the plants developed, at the point of inoculation, a small tumour, which by the end of another month had grown into a smooth, hard, round, greyish mass with the dimensions of a large walnut. Re-isolation gave pure cultures on bouillon-agar at 30° C. of an organism differing somewhat in its characters from the original strain.

The anti-*tumefaciens* serum agglutinates this strain at 1 in 400, the same effect being produced by the sera of rabbits immunized with the strains FF and T from rat tumours at 1 in 200.

REDDY (W. F.). **Black stem rust situation in Michigan.**—*Quart. Bull. Michigan Agric. Exper. Stat.*, viii, 3, pp. 148–151, 1926.

The survey activities in connexion with barberry eradication in Michigan for the control of black stem rust [*Puccinia graminis*] of wheat and other cereals are briefly summarized and an account is given of the life-history of the fungus. During the campaign an area of 57,480 sq. miles has been covered (in part more than once), and 458,783 bushes together with over 1,500,000 seedlings destroyed.

MORRIS (H. E.) & POPHAM (W. L.). **The Barberry eradication campaign in Montana.**—*Montana Agric. Exper. Stat. Bull.* 180, 24 pp., 5 figs., 1 map, 1 diag., 1925. [Received May, 1926.]

An account is given of the work of barberry eradication in Montana for the control of black stem rust of wheat (*Puccinia graminis*), which is estimated to have caused an average annual loss of 50,000,000 bushels of small grains in the United States during the last twelve years. From 1915 to 1924 the losses in Montana alone amounted to 14,800,000 bushels of wheat. A summary of the work to the close of 1925 shows that 11,100 bushes on 292 properties have been eradicated since the preliminary survey was made in 1918. In addition, 4,771 seedlings (some obviously

grown from seeds scattered by birds) have been destroyed. Examples of local stem rust epidemics directly traceable to barberry bushes are cited. In 1924 a single purple barberry, heavily infected, spread the disease to native grasses and thence to a field of Dale Club wheat, in which the incidence of infection varied from 80 per cent. of the crop near the barberry to 4 per cent. on the outskirts. In 1925 rust spread from barberry bushes to Marquis wheat half a mile away.

MAINS (E. B.) & JACKSON (H. S.). **Physiologic specialization in the leaf rust of Wheat, Puccinia triticina Erikss.**—*Phytopath.*, xvi, 2, pp. 89–120, 4 pl., 1926.

A study of the leaf rust of wheat (*Puccinia triticina*) was begun at Purdue University, Indiana, in 1918 [see this *Review*, i, p. 166]. The present paper embodies the results of an investigation on physiological specialization in the fungus.

It was ascertained that at least twelve biologic forms [a key to the determination of which is given] may be distinguished by the manner in which they infect eleven selected differential strains of wheat, namely Malakoff, C.I. 4898; Turkey 47; Norka, C.I. 4377; Mediterranean, C.I. 3332; Hussar, C.I. 4843; Democrat, C.I. 3384; Webster, C.I. 3780; and the unnamed spring varieties, C.I. 3756, 3778, 3747, and 3779. All these varieties, as well as fourteen others, were found to be more or less resistant to one or more forms of the fungus.

No form has hitherto been found to which all these varieties are susceptible. On the other hand, only one variety, Vernal Emmer, S.D. 293, has proved highly resistant, in the seedling stage in the greenhouse, to all twelve forms.

The biologic forms of *P. triticina* are generally found to be mixed in the field, and pure lines were therefore developed from monospore cultures for their study and identification. These forms are neither fixed nor limited in their distribution. Apparently those strains to which Malakoff, C.I. 4898, is susceptible are most prevalent in the central west, while those to which this variety is resistant are more common in the east and south.

While the writers believe that it would be preferable to regard all the leaf rusts of cereals and grasses of the type of the old *P. rubigo-vera* as a single morphological species with numerous physiological forms [see this *Review*, iv, p. 213], the general use in literature of names such as *P. dispersa* for the form on rye and *P. triticina* for that on wheat may render such a change undesirable.

FROMME (F. D.). **Susceptibility of Wheat varieties and selections to loose smut.**—Abs. in *Phytopath.*, xvi, 1, pp. 86–87, 1926.

The inoculation of the florets of the Stoner and Leap varieties of wheat with loose smut [*Ustilago tritici*] produced 62 per cent. of infection in the former and only 3 per cent. in the latter variety. Some pure lines of Fulcaster are very susceptible, others moderately so, while some are highly resistant. The most susceptible selection is stated to be eight times as susceptible as the Fulcaster parent, and the most resistant twenty times as resistant as Fulcaster. The

probability of developing a highly resistant strain of Fulcaster through pure line selection is indicated by these results.

WEISER (S.). **Der Nährstoffgehalt von brandsporenhaltigen und brandsporenfreien Koppereistauben.** [The food content of smut-containing and smut-free fodder brans.]—*Fortschr. der Landwirtsch.* [Vienna], i, 6, pp. 169–171, 1926.

Experiments carried out at the Budapest Institute of Veterinary Physiology indicate that feeding sheep with wheat bran mixed with the spores of bunt [*Tilletia tritici* and *T. levis*] is liable to cause serious injury to the animals by the production of toxic metabolic substances in the digestive tract. Pigs are stated to be affected to an even greater degree.

HILGENDORFF (G.). **Ueber die Verwendung einiger Quecksilberbeizmittel in der wiederholten Tauchbeize.** [The use of certain mercurial disinfectants in repeated immersion.]—*Zeitschr. Angew. Chemie*, xxxix, 11, pp. 377–379, 1926.

In connexion with the experiments of Gassner [see this *Review*, iv, p. 492] and Krauss [see this *Review*, v, p. 222] in the replenishment of stock solutions of various standard mercurial fungicides [used chiefly against *Tilletia tritici* and *T. levis* on wheat], the writer describes the technique and results of a series of similar tests conducted at the Biologische Reichsanstalt with uspulun, germisan, and urania.

It was ascertained that for original solutions of 0·5 and 0·25 per cent. uspulun the necessary strength of the reserve solution used for replenishment is 0·96 and 0·57 per cent.; the corresponding figures for germisan are 0·86 and 0·40 per cent., and for 0·25 per cent. urania, 0·52 to 0·55 per cent. The discrepancy between these data and those obtained by Krauss [loc. cit.] is thought to be due to various modifications in the technique employed.

The results of further experiments indicated that the numerous compounds, e. g., carbohydrates, nitrogenous and phosphatic substances, and the like, which diffuse from the seed-grain (Criewener winter wheat No. 104 in the case in point) into the disinfectant, are capable of fixing certain of the mercury compounds and hence of impeding, to some extent, the process of adsorption. Thus, after five repetitions the toxicity of a 0·5 per cent. uspulun solution was reduced by 71·7 per cent., the corresponding figure for germisan being 49·7 per cent.

SCHAFFNIT (E.). **Zum Stand der Trockenbeizfrage.** [On the position of the dry seed disinfection question.]—*Mitt. Deutsch. Landw. Gesellsch.*, xli, 17, pp. 361–364, 1926.

The writer has carried out experiments with a view to reducing the excessive quantity of water taken up by wheat grain immersed in seed disinfectants, by shortening the period of immersion. The preparations used were uspulun, tillantin B and C, Sch 676 and 679, and A.Z. 3. In 1924 five minutes' immersion in 0·25 per cent. uspulun completely eliminated bunt [*Tilletia tritici* and *T. levis*] in summer wheat, compared with 19 per cent. infection in the control.

In 1925 a 0·75 solution reduced the infection to a trace (from 39 to 0·15 per cent.). Five minutes' immersion in tillantin B (0·2 or 0·3 per cent.) gave complete control of bunt in summer wheat, while the same in tillantin C (0·3 per cent.) was almost equally effective in winter wheat. By immersion for 7·5 minutes the same effect was produced with 0·2 per cent. solutions of the latter and Sch 676. A.Z. 3 (0·75 per cent.) completely eliminated infection in five minutes. No reduction of germination or vigour resulted from any of these treatments.

In 1924 the writer tested against bunt in summer wheat various germisan dusts containing 5 to 50 per cent. germisan; a copper dust supplied by Merck, Darmstadt; Sch 614 and 615; an American brand of copper carbonate; and B 3 dust (Bayer, Leverkusen). The germisan dusts gave complete control in some cases, while in others up to 0·25 per cent. infection was recorded; Merck's copper dust, the American preparation, and B 3 were entirely satisfactory; while Sch 614 and 615 failed to eliminate bunt entirely. In the control plots there was 25 per cent. of infection. No reduction of germination followed any of the treatments. On the other hand, of the 18 preparations tested for the control of bunt in winter wheat, only Sch 614 and 1733 (Meyer, Mainz) proved efficacious, and these caused a reduction of germination. In 1925, Sch 614, 1733, Bayer's 84, 688 (Saccharinfabrik), P 257, 283, and 309 (Gold- und Silberscheideanst.) and Meyer's 1512 gave complete control of bunt in summer wheat as against 51 per cent. in the control.

Various factors involved in the action of the disinfectants on the seed-grain are discussed at some length. The writer's results in the control of the snow fungus [*Calonectria graminicola*] on rye [see this *Review*, v, p. 419] are briefly recapitulated, and the paper concludes with a short account of the various types of dusting apparatus on the market and their application to particular circumstances.

Riehm (E.). **Prüfung von Trockenbeizvorrichtungen.** [Examination of appliances for the dusting of seed grain.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst,* vi, 3, pp. 17–18, 1926.

The following appliances for the dusting of seed-grain have been officially examined by the German Plant Protection Service: Beizsack Halle (Güldenpfennig, Stassfurt); Ideal No. 1 (Mayer & Co., Köln-Kalk); Kuko (K. Konscholky, Breslau 13, Kaiser Wilhelmstr. 47); and Lothrä (F. Thränhardt, Leipzig S 3, Kaiser Wilhelmstr. 48).

All these effected a uniform distribution of the dust. In the case of Ideal No. 1 this was practicable only with a load of 25, not with 50 kg. The Lothrä effected the distribution in 5, the Ideal in 4½, the Halle in 3, the Primus in 2½, and the Kuko (with 75 kg.) in 4 minutes.

The Ideal No. 1, Primus, Lothrä, and Halle require the services of two men (one of whom, except with the Halle, can assist in the movement of the grain); while the Kuko, which is still in the experimental stage, needs three men (one for moving the grain).

The prices of these appliances are (in Rentenmarks) as follows: Halle, 20; Primus B and Ideal No. 1, 75; Primus A, 175 or 200

(for working by hand or electricity, respectively); Lothrä, 150; and Kuko 110.

RIEHM (E.). **Trockenbeizvorrichtungen.** [Appliances for the dusting of seed-grain.]—*Mitt. Deutsch. Landw. Gesellsch.*, xli, 9, pp. 188–191, 3 figs., 1926.

This account of an official inspection of various types of apparatus for the dusting of seed-grain contains the following points of interest in addition to those already noticed [see preceding abstract]. Primus B and Ideal No. 1 should not be filled with more than 0·5 cwt. of grain. With the former about 1 cwt. more grain can be treated per hour than with the latter, and the manipulation is somewhat easier. With both these appliances great care must be taken to turn the drum slowly. Primus A is somewhat superior to Lothrä in respect of construction and quantity treated per hour. The Primus appliances are the easiest to empty and clean on account of their large openings.

TAPKE (V. F.). **Single-bath hot-water and steam treatments of seed Wheat for the control of loose smut.**—*U.S. Dept. of Agric. Bull.* 1383, 29 pp., 4 figs., 1926.

Further investigations are described on the hot-water treatment of seed wheat for the control of loose smut (*Ustilago tritici*) [see this *Review*, iii, p. 712]. Single-bath treatments were studied with a view to finding a method less injurious to germination than the existing 'modified hot-water' process, and also steam treatments devised so as to use the commercial grain driers for steaming and for drying the treated grain with warm air. It is pointed out that these methods are suitable only for co-operative plants or where large quantities of seed wheat are handled.

Treatments at 48° C. for 110 minutes and at 49° for 95 minutes gave the best results as regards smut control. Germination was somewhat poorer than in the untreated seed but better than in that treated by the modified hot-water method, and the yield was considerably greater.

Two kinds of machines are stated to be available which could be used in combination to treat large quantities of wheat by the single-bath method and to dry the wheat so treated, namely, a type used in canneries by which the seed is carried through the hot water on endless belts, and a rotary grain drier.

Steam treatments were applied in an upright grain drier with a capacity of 2 bushels of wheat, and similar, except in size, to the standard driers. A saturated re-circulating atmosphere was maintained in the drier at temperatures suitable for seed treatment (46° to 49°), with only slight variations, by means of a return pipe attached to the outlet of the drier. The seed was soaked in cold water for four hours before steaming and then placed in the drier and steamed for one to five hours. It was found that the seed steamed at 46° for one to four hours, at 47° for one to two and a half hours, and at 48° for an hour effectively controlled loose smut without material injury to either germination or yield, while 46° for more than three hours and 47° for more than two hours reduced bunt [*Tilletia levis*] to a trace.

KIRSTE (A.). **Erfahrungen mit Heisswasserbeize in der landwirtschaftlichen Praxis.** [Experiments with hot-water disinfection in agricultural practice.]—*Pflanzenbau*, ii, 17, pp. 272–273, 1926.

Experiments were carried out in the disinfection of barley and wheat seed-grain against loose smut [*Ustilago nuda* and *U. tritici*] by hot water. The grain was pre-soaked for four to five hours in water at 25° to 35° C. and then immersed for ten minutes at 52° to 53°. On the whole, the results of the treatment were satisfactory, especially in the control of loose smut of barley, but infection was by no means completely eliminated. Attention is drawn to a number of practical points in connexion with the treatment, e. g., the necessity for rapid drying of the treated grain, which in the case of Criewener 104 wheat absorbed water at the rate of 22 lb. per cwt.; the risk of depredations by rats and crows, which appear to prefer grain treated in this manner; and the effect of hot water in causing the bursting of any bunt [*Tilletia tritici* and *T. levis*] balls that may be present.

FRASER (W. P.), SIMMONDS (P. M.), & RUSSELL (R. C.). **The take-all disease in Canada.**—Abs. in *Phytopath.*, xvi, 1, pp. 80–81, 1926.

During 1923 to 1925 a survey of the semi-wooded areas of north-eastern Saskatchewan and north-central Alberta revealed considerable damage from take-all (*Ophiobolus cariceti*) [*O. graminis*: see this *Review*, v, p. 223] in the spring wheat fields. The disease, which was not observed in the prairie regions, occurred on the first crop after breaking, and was most severe on the second crop and in fields where wheat was grown for several years in succession. Mature perithecia, apparently of *O. graminis*, have been found on *Torresia odorata*, while the mycelium of the same fungus was found on *Bromus* spp. in wheat fields [see this *Review*, iii, p. 267]. Observations denote that the fungus is indigenous to the area under discussion, parasitizing a number of native grasses, especially those with rhizomes. Under greenhouse conditions all the members of the sub-species of *Triticum* were attacked, while in addition to the wild grasses listed by Kirby [see this *Review*, i, p. 381] the following proved susceptible: *Avena hookeri*, *B. inermis*, *B. latiglumis*, *B. porteri*, *Agropyron dasystachyum*, and *Elymus innovatus*.

NOBLE (R. J.). **Downy mildew of Wheat (Sclerospora macrospora, Sacc.)**—*Agric. Gaz. New South Wales*, xxxvii, 1, pp. 204–208, 4 figs., 1926.

In the western and south-western parts of the wheat belt of New South Wales, the downy mildew produced by *Sclerospora macrospora* [see this *Review*, iv, p. 151] was observed in 1925 on isolated plants, in one case over a considerable area. Affected plants were characterized by the development of abnormal ears, sometimes larger and longer than normal heads, with a thickened rachis and greatly elongated spikelets. In other cases the spikelets were almost suppressed, or the floral organs were transformed into branched, curled, and twisted leafy outgrowths. In general the affected parts were pale, stiff, and fleshy; sometimes the entire

plant was stunted and with numerous basal shoots which soon died back. No grain was produced in any of the diseased heads. Oospores of the fungus were found in large numbers in the leaves and heads.

It seems probable that the disease has been present in the State for some years, but has escaped notice. It is not thought to be likely to cause serious damage, unless the weather conditions are particularly favourable for its development.

PAPE (H.). **Ein neuer Fundort der Federbuschsporenkrankheit des Weizens in Deutschland.** [A new record of the plumed spore disease of Wheat in Germany.]—*Illus. Landw. Zeit.*, xlv, 39, pp. 481–484, 3 figs., 1925.

In June, 1925, the writer observed the occurrence of the so-called 'plumed spore' disease (*Dilophospora alopecuri*) [see this *Review*, iv, p. 409] on some 80 per cent. of a winter wheat crop covering about 10 acres in the Stendal district of Saxony.

The affected plants were stunted (a quarter or a third of their normal size), and the ears, which sometimes adhered to the leaf sheaths, were coated with a viscous, whitish, grey, or black substance. In some cases the stem immediately below the ear was spirally twisted. Irregular, yellowish or brownish spots, generally with a dark margin, were observed on the leaf sheaths, while the elongated lesions on the leaves were jet black with yellow borders. The pycnidia of the fungus were found on these spots. The leaves were also frequently twisted in spirals and were further characterized by undulations of the lamina. In some plants the internodes of the stems were almost crescent-shaped.

The presence of eelworms (*Tylenchus tritici*) was observed in a number of cases, and Atanasoff's theory as to their role in the etiology of the disease is briefly discussed and provisionally accepted.

In Germany the disease has been found exclusively west of the Elbe, principally in the south and south-western provinces. Infection is believed to have been conveyed by troops to the Rhine Provinces with French straw, while it presumably reached Baden on seed from Switzerland or the Tyrol.

Control measures should include thorough disinfection of the seed, deep ploughing under of the stubble immediately after harvest, destruction of refuse from threshing operations and of straw from diseased plants, and biennial crop rotation.

SCHAFFNIT (E.). **Zur Physiologie von Ustilago hordei Kell. u. Sw.** [On the physiology of *Ustilago hordei* Kell. & Sw.]—*Ber. Deutsch. Bot. Gesellsch.*, xliv, 2, pp. 151–156, 1926.

The smut masses of barley ears infected by *Ustilago hordei* are firmly cemented by fat, in which they are embedded and which may be readily extracted with the aid of ether as a semi-solid mass (melting-point 42° C.). The presence of fat around and within the spores probably accounts in part for the difficulty of controlling the disease by immersion in fungicidal solutions, which readily destroy the spores when the surrounding fat is removed.

On germination the promycelium forms sporidia in about 20

hours and these in their turn give rise directly to new sporidia. The best sources of carbon for their development were found to be saccharose, glucose, and maltose, while the nitrates of potassium and calcium constituted satisfactory sources of nitrogen. The soluble carbohydrates greatly stimulated the reproduction of the fungus at the expense of vegetative growth, while nitrogen compounds exercised the reverse effect.

The fungus was found to be extremely sensitive even to low concentrations (0·01 per cent.) of mild organic acids (e.g., tartaric or malic acid) in the medium, whereas a slightly alkaline reaction generally promoted growth. Staling of the cultures is marked by the cessation of sporidial formation but not of vegetative growth. Spore germination and sporidial formation are stimulated by the presence of oxygen, while when carbonic acid is in excess the sporidia are replaced by long germ-tubes which are capable of acting as infection hyphae. This is thought to explain the action of stable manure in increasing infection.

The mycelium developing from the sporidia penetrates the seedling in the same manner as in *Tilletia tritici.* The germ-tubes, enveloped in a cellulose sheath, perforate the sheathing leaf, penetrate the meristem of the growing-point, and eventually reach the primary, secondary, and tertiary shoots, the two latter being particularly liable to attack.

After a number of fruitless attempts to secure spore formation, successful results were finally obtained with biomalt agar cultures, which in three weeks turned clay-yellow, later olive-brown, deepening to nearly black in the centre. Dark masses of spores developed in the folds of the mycelial membrane. These resembled completely the spores formed in the ears under natural conditions, but attempts to germinate them failed.

DIETZ (S. M.). **The effect of the alternate hosts on physiologic forms.**—Abs. in *Phytopath.*, xvi, 1, pp. 83–84, 1926.

Aecidiospores of *Puccinia coronata* [*P. lolii*] from *Rhamnus caroliniana*, *R. cathartica*, *R. lanceolata*, *R. pinetorum*, *R. smithii*, and *R. rubra*, resulting from inoculation with teleutospores from *Avena sativa* [see this *Review*, iv, p. 410], produced normal infection on *Nothoholcus lanatus* in the greenhouse. Aecidiospores from *R. lanceolata* inoculated with teleutospores from *Calamagrostis canadensis* produced abundant uredospores on oats, while aecidia on *R. lanceolata*, produced by teleutospores on oats, formed numerous uredospores on *C. canadensis*. Aecidia collected on *R. alnifolia* in the open produced abundant uredinial infection on oats. Aecidiospores from *R. lanceolata*, produced by teleutospores from *Festuca elatior*, caused severe infection of *F. interrupta*, *Hordeum murinum*, and *Phalaris stenoptera*, and slighter on several other grasses, whereas repeated inoculations of these grasses with uredospores of *P. lolii festucae* failed.

DIETZ (S. M.). **Alternate hosts of Puccinia coronata. II.**—Abs. in *Phytopath.*, xvi, 1, p. 84, 1926.

Rhamnus alpina, *R. chlorophora*, *R. ilicifolia*, *R. infectoria*, *R. smithii*, and *R. tinctoria* have been found to be susceptible to

Puccinia coronata festucae [*P. lolii festucae*: see preceding abstract]. When inoculated with teleutospores of crown rust from *Festuca elatior*, *R. dahurica*, *R. dahurica* var. *nipponica*, *R. frangula*, and *R. japonica* became infected but produced no aecidia. *Berchemia scandens* and *Zizyphus lycoides* showed pycnidial infection, while *Ceanothus americanus*, *Elaeagnus angustifolia*, *Lonicera flava*, and *Z. obtusifolia* were copiously flecked by *P. lolii festucae*. *L. flava* also showed marked flecking by *P. lolii calamagrostis*. *R. cathartica* and *R. lanceolata* were again responsible for local epidemics of crown rust of oats in the Upper Mississippi Valley in the spring of 1925, the latter developing the heaviest aecidial infection for nine years. During 1925, 158 additional plantings of *R. cathartica* were located.

NEILL (J. C.). **Oat smut. Survey and experimental work, season 1925–26.**—*New Zealand Journ. of Agric.*, xxxii, 3, pp. 166–172, 1 fig., 1926.

Oat smut (*Ustilago levis* and *U. avenae*) is reported to have destroyed 600,000 bushels of oats in Canterbury, Otago, and Southland (New Zealand) during the season 1925–6. The author has carried out a series of experiments in its control by seed treatment, the results of which are presented in tabular form. Formalin (1 pint to 40 galls. water, or 1 to 320, for 10 minutes) is the best of the methods now in use by the farmers, and reduced the disease, in the author's experiments, from 20 to 50 per cent. in the controls down to 0·3 to 4 per cent. in the treated plots, with little or no injury to germination. The hot water treatment (dipping for 10 minutes at 127° to 133° F.) was the only one tested which completely disinfected the seed, but the results were somewhat irregular and further experiments are required.

Uspulun, germisan, semesan, and corona 640 (0·25 per cent. solutions) and semesan dust (2 oz. per bushel) all failed to secure complete control, but all increased the stand of mature plants.

Copper carbonate dusts had a similar effect, reducing infection to about 5 per cent., as compared with 25 to 40 per cent. in the control plots; colloidal copper dusts were less effective. Copper sulphate reduced the germinative energy and, on the average, the stand was smaller than in the controls; smut was reduced to about 4 per cent.

REED (G. M.). **Plant pathology. Disease resistance.**—*Fifteenth Ann. Rept. Brooklyn Bot. Gard., 1925*, pp. 55–57, 1926.

A considerable amount of further work has been done in connexion with the study on varietal resistance and susceptibility to loose and covered smut of oats (*Ustilago avenae* and *U. levis*) [see this *Review*, iv, pp. 663, 731; v, p. 27]. A few of the numerous smut collections from various regions indicate the existence of distinct new races definitely limited to certain varieties. Among these is a strain apparently capable of attacking the hitherto resistant Fulghum variety [see this *Review*, iv, p. 535]. Black Mesdag has proved resistant to all the races studied up to the present time.

Investigations have been made on the inheritance of susceptibility of certain sorghum hybrids to covered kernel smut (*Sphacelotheca*

sorghi) [see this *Review*, v, p. 88]. The progeny of two different crosses, each comprising a resistant and a susceptible parent, were inoculated and their susceptibility determined. In one of the crosses the F_2 plants proved quite susceptible, almost as many individuals being infected as in the case of the susceptible parent. In the other cross, however, relatively few of the F_2 plants became infected. These results indicate that different factors, the nature of which is still obscure, are involved in the two series.

Head smut of sorghum and maize (*Sorosporium reilianum*) was also investigated. In the writer's experiments a rather low percentage of infection was obtained on sorghum, while in some cases very severe infection occurred on maize. It would appear from the tests that the smut from maize is not transmissible to sorghum and vice versa.

TISDALE (W. H.), MELCHERS (L. E.), & CLEMMER (H. J.). **A strain of Sorghum kernel smut which infects Milo and Hegari.**—Abs. in *Phytopath.*, xvi, 1, p. 85, 1926.

Experiments carried out in 1924–5 showed that the smut from the Milo and Hegari varieties of sorghum [see this *Review*, iv, p. 597] infects pure lines of those varieties as well as the sorghums susceptible to the commonly occurring strain of *Sphacelotheca sorghi* to which the former are almost immune. Feterita was not infected. Infected heads of Milo and Hegari are frequently only partially smutted by this new strain, which is thought to agree more closely with *S. sorghi* than with *S. cruenta*.

NILSSON (G.). **Några betningsmedels skördestegrande inverkan på Fusariumsmittat utsäde.** [The effect of certain disinfectants in augmenting the yield of seed-grain infected by *Fusarium*.]—*Landtmannen*, ix, 16, pp. 224–225, 1926.

A series of experiments was carried out in 1924–5 at the Värmland (Sweden) Seed Testing Station to ascertain the effect of various fungicides on the yield of summer and winter wheat, rye, and oats infected by *Fusarium* and other fungi. Dusting with uspulun reduced the incidence of *Fusarium* on winter wheat from 5·8 to 4 per cent., and that of bunt [*Tilletia tritici* and *T. levis*] from 6·3 to 0·9 per cent. The increased yield in the dusted plots amounted to 20·6 per cent., the corresponding figure for summer wheat being 15·7 per cent. The yield of rye heavily infected by *Fusarium* [*Calonectria graminicola*] (germination reduced to 59 per cent.) was increased by 35·7 per cent. in 1924 and by 17·8 per cent. in 1925 by dusting with uspulun. The oat crop was increased by 10·7, 21·4, 18·1, 6·7, and 14·7 per cent. by uspulun dust, one hour's immersion in 0·25 per cent. uspulun, 30 minutes' immersion in 0·25 per cent. germisan, one hour's immersion in 0·2 per cent. tillantin B, and the same period in tillantin C, respectively. Oat smut [*Ustilago avenae*] was reduced by all the treatments.

JOHANN (HELEN), HOLBERT (J. R.), & DICKSON (J. G.). **A Pythium seedling blight and root rot of Dent Corn.**—Abs. in *Phytopath.*, xvi, 1, p. 85, 1926.

During the past few years a species of *Pythium* has been found associated with root rots of Dent maize in Illinois and Wisconsin.

It is somewhat closely related to the species causing root rot of sugar-cane [see this *Review*, iv, p. 505] in its lobulate sporangia and smooth oogonia and oospores. Infection usually occurs at the tips of rootlets and proceeds proximally, producing a soft rot which involves first the cortex and later the vascular elements. Soil temperatures of 12° to 16° C. and high soil moistures tend to favour the development of this form of blight, which prevents germination. In milder cases the seedlings may be stunted by the soft rot of the feeding roots. The average reduction in a stand of 18 pedigree strains of maize inoculated in the cold, wet spring of 1924 was 30 per cent. The maximum reduction in yield of sound maize per plant was 65 per cent. in one strain.

TRYON (H.). **Ear rot of Maize.**—*Queensland Agric. Journ.*, xxv, 3, pp. 237–258, 4 pl., 1926.

The symptoms, life-history, origin, and mode of infection of ear rot of maize (*Diplodia zeae*), first recorded from Queensland in 1919, are fully described in popular terms. The writer's information is stated to be mainly based on the examination of selected cobs from the Atherton Tableland district of Queensland, where the disease is reported to be most prevalent during wet weather after a dry spell and on areas which have been under maize for long periods. The fields from which the samples were taken in 1925 showed 12 to 45 per cent. infection. Recommendations for the control of the disease include intermission in maize cultivation by fallowing or crop rotation; harvesting soon after the grain matures and transferring the cobs to special bins for drying out, thereby reducing the amount of infective material in the fields; use of clean seed; and timing the growth of the crop in such a way that silking (the critical stage for infection) does not coincide with or immediately follow a wet period.

STAKMAN (E. C.) & CHRISTENSEN (J. J.). **Physiologic specialization of Ustilago zeae and Puccinia sorghi and their relation to Corn improvement.**—Abs. in *Phytopath.*, xvi, 1, p. 84, 1926.

The only promising method of control of maize smut (*Ustilago zeae*) appears to be the production of resistant lines [see this *Review*, v, p. 225], but the existence of several forms of the fungus (for which evidence is stated to be available) is likely to complicate the work of development. *Puccinia sorghi* [*P. maydis*], which is usually considered relatively innocuous, caused appreciable damage in 1925 on certain selfed lines of maize at Minnesota University. The maize rust situation is also complicated by the existence of several physiologic forms, at least three of which have been recognized by their action on eight selfed lines of maize. A very virulent form was collected in Oklahoma, Kansas, Nebraska, and New Hampshire; a less virulent form from several localities in Minnesota; and a very weak one from Texas.

WEBBER (H. J.). **The Citrus industry in South Africa.**—*California Citrograph*, xi, 1, pp. 3, 18, 20; 2, pp. 44, 58–61, 8 figs., 1925. [Received May, 1926.]

In the first part of this paper the writer gives a concise account

of the development of citrus growing in South Africa since the introduction of orange trees from St. Helena in 1654; and briefly discusses shipping conditions, the financial status of the industry, and modes of cultivation and propagation. The second part deals with fungous diseases, insect pests, and the development of new citrus varieties.

In the humid coastal areas of Natal and Cape Colony a brownish, felt-like growth, probably due to a species of *Septobasidium*, causes some damage to the leaves and stems.

The fruit rots common in California, e.g., brown rot [*Pythiacystis citrophthora*], blue and green moulds [*Penicillium italicum* and *P. digitatum*], stem-end rot (*Alternaria*), and the like, are also prevalent in South Africa.

Scaly bark [psorosis: see this *Review*, v, p. 297] is so far abundant in a few groves only, and could readily be exterminated at the present stage.

Root or collar rot [see this *Review*, i, p. 12] is stated to be the most common and alarming fungous disease in South Africa.

Citrus scab [*Sporotrichum citri*] and melanose [*Phomopsis citri*] have been found in the damp, low-lying veldt areas and coastal regions of South Africa, but are not yet generally distributed.

A bacterial disease very similar to the Californian citrus blast occurs in one section of South Africa, but appears to be due to a different organism, *Bacillus citrimaculans* [*Ann. Appl. Biol.*, iii, p. 53, 1917], while blast is caused by *Pseudomonas citriputeale*. The lesions produced by the two organisms, however, are very similar, and they may eventually be found to be identical.

Little is known concerning the ring blotch or concentric ring spot disease common in the interior [see this *Review*, v, p. 279]. Spots from one-quarter to one-half an inch in diameter form alternate light and dark concentric circles on the leaves and young stems. The irregularly distributed spots may involve almost the entire leaf area or they may occur only on a few leaves. A serious reduction of vitality results from severe infection. The disease has been variously attributed to malnutrition or to a bacterium or virus.

In general, fungous diseases in South Africa occupy about the same position of importance in the citrus industry as they do in California or Florida, but much less attention is said to be given to their control. Among other factors tending to reduce the likelihood of South Africa becoming a serious competitor in the citrus markets of the world are the difficulties connected with efficient disease and pest control, the paucity of high-class, intelligent labour, and transit and storage problems.

LEWCOCK (H. K.). **A Citrus bacteriosis occurring in South Australia.**—Abs. in *Phytopath.*, xvi, 1, p. 80, 1926.

At intervals during the last decade the bacterial disease of citrus fruits due to *Pseudomonas citriputeale* is stated to have caused losses amounting to 30 or 40 per cent. of the crop in districts of South Australia and Victoria with a moderately heavy rainfall [see this *Review*, iv, p. 399]. The disease develops on tree-ripe fruit in

the winter and spring months. In the early stages, the dry, reddish-brown lesions are circular or oval, but they may rapidly extend over a large part of the surface unless dry weather intervenes. The diseased tissue is depressed somewhat below the bottom of the normal oil glands into the white portion of the rind, but does not extend into the pulp. There is a distinct line of demarcation between the infected and healthy tissue.

TUCKER (C. M.). **Phytophthora bud rot of Coconut palms in Porto Rico.**—*Journ. Agric. Res.*, xxxii, 5, pp. 471–498, 19 figs., 1 map, 1926.

A very detailed account of the bud rot of coco-nuts in Porto Rico [see this *Review*, v, p. 283] is given. The disease has been known for some 14 years, but does not appear to be of great importance. From affected palms a small-chlamydospored strain of *Phytophthora palmivora* was isolated, and this was proved to be the cause of the disease. In pure culture most of the conidia measured fell in the classes 41 to 60 by 27 to 35 μ and most of the chlamydospores were 25 to 43 μ.

Inoculation tests under field conditions showed that lateral penetration occurs through the tender leaf bases (both wounded and unwounded) and also vertically in the central column of leaves. No infection resulted from lateral inoculation of the older, tough leaf bases, and even when the inner ones become infected, progress may cease before the centre of the bud is reached. Definite symptoms of the disease were not usually visible until from three to nine months, or even longer, after inoculation. The fungus was re-isolated from all the inoculated cases that contracted the disease. Two of the wounded but not inoculated control palms developed a disease resembling bud rot, but which did not prove fatal. In some of the inoculations by pouring a suspension of the fungus down the central column of unexpanded leaves, rows of spots developed on the pinnae. In the fatal cases infection of the growing point was observed.

Bacteria were found abundantly in the rotted tissues, and were used for inoculation on wounded leaf bases. Only one palm out of eight thus inoculated died from the wound having reached the growing-point, though the inoculations set up a limited rot in the others. In some cases sterile broth caused similar symptoms.

Observations made at irregular intervals on the western coast indicate that high precipitation has a marked effect on the development of bud rot, the limits of the infected area falling within the zone of 80 to 90 inches rainfall. The earliest symptoms are most frequent in November and December, immediately following the rainy season. The fungus may remain dormant in the leaf base during the dry season. Young protected palms and those in low moist situations are especially susceptible.

No direct experimental evidence has been obtained regarding the dissemination of bud rot, but wind and probably insects are thought to be the most important factors.

Control experiments have shown that the incidence of the disease is reduced by the eradication of infected palms.

Tucker (C. M.). **The black root disease in Coffee seed beds.**—*Agric. Notes, Porto Rico Agric. Exper. Stat.*, 23, 2 pp., 1926.

In connexion with the increasing prevalence in Porto Rico of the practice of planting coffee in seed-beds for transplanting, which is stated to be superseding the old method of transplanting volunteer seedlings from under bearing trees, the writer points out the risk of infection by black root (*Rosellinia* sp.) and other root diseases from this source. Specimens of dying seedlings from nurseries in widely separated localities have recently been examined, and in each case they were found to be invaded by the black root fungus. Affected plants first show a wilting of the foliage which may not appear until well after transplanting, and which is found, on closer inspection, to be associated with the presence of dark brown to black strands or crusts on the roots, collar, and base of the stem. The bark is usually underlaid by black, matted mycelium, and small black dots or streaks may be observed in the wood. Directions are given for the prevention of infection from seed-beds by the choice of a site not previously used for coffee; destruction of infected material; transplantation from healthy seed-beds only; and care in the application of fertilizers, the use of organic matter from old coffee plantations being inadvisable. [A summary of this paper is given in *Rev. Agric. de Puerto Rico,* xvi, 3, pp. 129–130, 1926.]

Ajrekar (S. L.). **The cause of Cotton wilt in India.**—*Journ. Indian Bot. Soc.*, v, 1, pp. 1–8, 1926.

In continuation of his previous experiments on cotton wilt in the Central Provinces of India [see this *Review*, i, p. 292], the writer carried out a further series of tests in 1921–2 in which disinfected cotton seeds were sown in sterilized soil inoculated with strains of *Fusarium* sp. from Dharwar and Nagpur. The latter gave positive results in a high proportion of the tests on the Suratee Broach Gi, Selection IA, Ghogari E5, and Ghogari B21 varieties, while the former attacked a large number of the Broach Deshi Plants 4 and 5 sown in infected soil. The Broach Deshi Plant 6 was immune.

The results of these tests are regarded as conclusive proof of the parasitic nature of the *Fusarium* strains from both the localities in question.

The writer examines Dastur's reasons for doubting the parasitism of the cotton *Fusarium* [see this *Review*, iii, p. 720] and finds them unconvincing. In the first place, Dastur's plants were grown under abnormal conditions of starvation and water-logging or reduction in root surface. Moreover, the theory of the accumulation of iron and aluminium salts [loc. cit.] would seem to be applicable only to acid soils, and, so far as the writer knows, the cotton soils are not acid either in the Central Provinces or in the Bombay Presidency.

Weidman (F. D.). **Morphologic variations in a ringworm species of the toes followed in primary cultures over a period of years.**—*Arch. of Dermatology,* xiii, 3, pp. 374–382, 3 figs., 1926.

Following the implantation of a non-pathogenic yeast directly on a ringworm lesion of the toes, a species of *Trichophyton*, the primary culture of which had shown a constant morphology for

five years, suddenly changed from the downy to the powdery type of growth. Microscopically the new strain exhibited characters typical of the *T. gypseum* group (satellite colonies in the periphery of the parent, spirals, intercalary chlamydospores, and the like), most of which are compatible with the descriptions of *T. interdigitale*, *T. asteroides*, and *T. radiolatum*. In determining the species, especially of the *T. gypseum* group, due allowance must be made for such mutations.

ALTARA (M. I.). **Nouvelles recherches sur la 'crête blanche' de la poule.** [New researches on 'white crest' of the fowl.]—*Rev. Gén. de Méd. Vétér.*, 23 pp., 9 figs., 15th March, 1925. [Abs. in *Bull. Inst. Pasteur*, xxiv, 3, pp. 130–131, 1926.]

Cultures of the organism producing 'white crest' of fowls were readily obtained on Sabouraud's medium. A raspberry-coloured pigment was formed on this medium, on those containing glycerine, and on potato. Profuse development of intercalary chlamydospores and of spindles was observed. Inoculation experiments gave positive results on fowls, guinea-pigs, rabbits, dogs, cats, lambs, kids, and calves; negative on horses and rats; and doubtful on man. From these results and a histological examination the writer concludes that 'white crest' is a genuine trichophytosis and not a favus, and that it is caused by the fungus *Lophophyton gallinae*.

HENRY (A. W.). **Inheritance of immunity from Melampsora lini.** —Abs. in *Phytopath.*, xvi, 1, p. 87, 1926.

Crosses were made between varieties of *Linum usitatissimum* immune from and susceptible to *Melampsora lini* [see this *Review*, iv, p. 416], including both fibre varieties [flax] and seed varieties [linseed]. Three immune parents were used, namely, a selection of commercial Argentine flax; Bombay (C.I. 42); and Ottawa 770 B. The F_1 plants of all crosses were immune. The segregation in the F_2 cross between the Argentine selection and the susceptible Saginaw fibre variety approximated to a ratio of 15 immune plants to one susceptible. The F_2 of a cross between Bombay and the susceptible Winona linseed showed a simple monohybrid segregation. Apparently there was a single factor difference between immunity and susceptibility in a cross between Ottawa 770 B and Saginaw. A ratio of three blue-flowered, brown-seeded plants (Saginaw) to one white-flowered, yellow-seeded plant (Ottawa) was obtained in the F_2. These characters are approximately linked, and were inherited independently of immunity from rust, so that in the F_2 a segregation approximating to a 9 : 3 : 3 : 1 ratio was obtained.

BROADFOOT (W. C.) & STAKMAN (E. C.). **Physiologic specialization of Fusarium lini, Bolley.**—Abs. in *Phytopath.*, xvi, 1, pp. 84–85, 1926.

At least eight forms of *Fusarium lini* [see this *Review*, iv, p. 282] may be distinguished by their parasitic action on the following varieties of flax: Primost, Minn. 25 (C.I. 177); Winona, Minn. 182 (C.I. 179); N.D. 3080 (C.I. 275); N.D. 40013 (C.I. 241). Six of the forms differ greatly in virulence. Two are about equally

virulent, except that one consistently caused loss of chlorophyll above the cotyledons in all varieties of flax inoculated. Neither cultural and physiological characters nor spore morphology afford reliable criteria for the differentiation of these forms, some of which produce heavy infection on certain resistant varieties of flax.

BERGER (P.). **Maladie du Rosier.** [A disease of Rose trees.]—*La Vie Agric. et Rurale*, xxviii, 10, pp. 157–158, 1926.

A brief popular account is given of the grey rot of rose bushes caused by *Botrytis cinerea*, which is stated to have become very prevalent in French parks and gardens. The following control measures have been adopted of recent years : a winter application to the bushes of 5 per cent. bisulphite of lime, followed by a summer treatment with a dust consisting of 10 kg. of bisulphite of lime and 90 kg. of clay.

HECKE (L.). **Die Ansteckung von Blattachselknospen durch Ustilago violacea (Pers.) Fuck.** [The infection of leaf axil buds by *Ustilago violacea* (Pers.) Fuck.]—*Fortschr. der Landwirtsch.* [Vienna], i, 5, pp. 150–151, 1926.

The writer briefly describes his experiments in the inoculation of the leaf axil buds of *Melandrium album* plants from disinfected seed with *Ustilago violacea*. Successful results were obtained in every case by brushing fresh spore dust on to the previously moistened buds, all of which developed smutted flowers. Blossom infection in the sense described by Werth (*Arb. Biol. Anst. Land- u. Forstwirtsch.*, viii, 3, 1911) was excluded by the previous removal of all the flowers.

GANTE (T.). **Untersuchungen über Welkekrankheiten der Sommeraster.** [Investigations of wilt diseases of the Summer Aster.]—*Zeitschr. für Pflanzenkrankh.*, xxxvi, 3–4, pp. 72–79, 1 fig., 1926.

The following are the chief symptoms observed by the writer in connexion with the wilt disease of summer asters [*Callistephus chinensis*], which is stated to be causing widespread damage in Germany [see this *Review*, iv, p. 168]. Apparently healthy plants are suddenly attacked by a generalized wilt, in which the stem bases are uniformly discoloured while the roots are apparently healthy. The basal discoloration gradually extends for a distance of some centimetres up the stem, and the plants then die off more or less rapidly. The disease usually occurs shortly before flowering, though plants in full bloom may also succumb.

Infected plants showed a discoloration of the cell walls of the cortex, in which dark stripes were visible. These areas were mainly confined to the stem bases and tap roots, and in no case did they extend, as in Osterwalder's material (*Landw. Jahrb. Schweiz*, xxiv, p. 246, 1910), to the junction of the branches and the stem. Hyphae were observed, strictly localized, in some of the vascular tissues in the affected region, and this partial obstruction is thought to be responsible for the rapid wilting of the plants. Infection is believed to occur through the root collar. Only in one case were bacteria apparently involved in a soft rot of the stem base, though

they were frequently observed as secondary agents of decay in wilted plants.

Species of *Fusarium* were consistently isolated from diseased material. In 1922 a species was isolated which formed septate, falcate spores on aster decoction agar. In 1924 and 1925 the following species were isolated: *F. graminum*, *F. polymorphum*, *F. culmorum*, *F. falcatum* (all determined by Wollenweber), and *F. dimerum*.

Inoculation experiments with *F. graminum*, *F. culmorum*, *F. falcatum*, and the undetermined species isolated in 1922 gave negative results. These tests, however, were conducted on a very small scale, and it may be assumed that certain species of *Fusarium* are concerned in the etiology of the wilt.

The control measures recommended by previous investigators include care in the disposal of infected material; use of healthy soil for seed-beds; seed disinfection with 0·25 per cent. uspulun [see this *Review*, iv, p. 220]; and the application of caustic lime to the soil (*Erfurter Führer*, xxiii, p. 332, 1923). The writer emphasizes the great importance of using soil on which no asters have been grown for several years, and cites examples of severe infection in nurseries where this precaution was neglected, while his own seedlings from the same source, planted on fresh soil, remained healthy.

SCHENK (P. J.). **Parasitair omvallen van Tulpen.** [Parasitic wilt of Tulips.]—*Floralia*, xlvii, 6, pp. 88–89, 1 fig., 1926.

Referring to the blossom blight of tulips described by Stevens and Plunkett as due to *Phytophthora cactorum* [see this *Review*, iv, p. 739], the writer suggests that the disease is probably identical with the non-parasitic wilt of Murillo and other varieties reported from Holland [ibid., v, p. 33]. The symptoms in the two cases are similar, and the American inoculation experiments are not regarded as affording conclusive proof of the parasitic nature of the disease. *P. cactorum* is thought to be probably a secondary agent of decay.

ALCOCK (Mrs. N. L.). **A preliminary note on a Phytophthora on Atropa belladonna.**—*Pharmaceut. Journ.*, cxvi, 3254, p. 232, 1 fig., 1926.

A species of *Phytophthora*, which has been provisionally named *P. erythroseptica* var. *atropae*, is stated to cause a virulent disease of *Atropa belladonna* in the early summer in Scotland. The base of the stem is attacked, and in some cases the mycelium penetrates the whole of its thickness, cutting off the water supply and causing a severe wilt of the plant above the point of infection. The fungus is also responsible for a damping-off of *Atropa* seedlings. It is thought that infection may possibly have been introduced on some drug plant from abroad. The causal organism differs from *P. erythroseptica* [see this *Review*, ii, p. 385] in the following particulars: (1) It does not attack potatoes in the field; (2) it is primarily a stem rot; (3) it forms masses of oospores *in situ*, while *P. erythroseptica* rarely produces them in the potato tuber or haulm; (4) the sporangia measure 48 by 30 μ compared with 32 by 20 μ in *P. erythroseptica*; and (5) the pink flush characteristic of *P. ery-*

throseptica does not appear on potato tubers artificially inoculated with the fungus from *Atropa*, though the latter will grow on the tubers.

BECK (OLGA). **Eine Krankheit an Liguster-Sämlingen und -Zweigen (Myxosporium cingulatum, bezw. Gnomonia cingulata n. sp.).** [A disease of Privet seedlings and branches (*Myxosporium cingulatum* or *Gnomonia cingulata* n. sp.).]—*Zeitschr. für Pflanzenkrankh.*, xxxvi, 3–4, pp. 65–71, 7 figs., 1926.

In June, 1925, the writer examined a number of privet [*Ligustrum vulgare*] seedlings from a silvicultural experiment station near Vienna, which showed symptoms similar to those of the anthracnose first described by Atkinson and recently reported by Mix [see this *Review*, iv, p. 672] from the United States.

The conidial stage of the causal organism developing under laboratory conditions on the girdled stems of the affected material was identified as a species of *Myxosporium*, while the perithecia appearing after a week in the damp chamber were found to belong to the genus *Gnomonia*.

After two months on a beerwort-agar medium the *Myxosporium* conidia developed numerous typical *Gnomonia* perithecia containing ascospores. The connexion between the two stages may thus be regarded as established. The name *Gnomonia cingulata* n. sp. is proposed for this fungus.

Inoculation experiments with the *Myxosporium* spores on ten wounded one-year-old branches produced the typical symptoms of the disease, namely, girdling of the twigs and wilting and discoloration of the leaves.

The disease is not likely to prove of much importance on full-grown bushes, but it may be very serious on seedlings, causing total destruction of the shoots. The only control measures which can be recommended are the removal of all infected material and the use of healthy seed-beds, possibly supplemented by prophylactic treatment with Bordeaux mixture.

MASSEY (L. M.). **The story of fireblight and its control.**—*Proc. New York State Hort. Soc.*, lxxi, pp. 52–58, 1926.

The available information on the etiology and control of fireblight (*Bacillus amylovorus*) is summarized in popular language, with notes on varietal susceptibility of apples and pears, the life-history of the causal organism, and other points of interest.

OPPENHEIMER (H. R.). **Verhütung und Heilung krebsartiger Pflanzengeschwülste (Wurzelkropf der Obstbäume).** [Prevention and cure of cancerous plant tumours (crown gall of fruit trees).]—*Angew. Bot.*, viii, 1, pp. 8–29, 6 figs., 1926.

It is stated that the disease known in Germany as 'Wurzelkropf', which is characterized by cylindrical or fusiform swellings of the roots of young fruit (chiefly apple and pear) stocks, has not been proved to be due to *Bacterium tumefaciens*, though there is scarcely any doubt that it is caused by a soil-dwelling organism. One-year-old seedlings suffer most severely from the disease, which may

destroy 80 per cent. of the stand. The disintegration of the tumours, which may occur in the first year of attack, is usually followed by the development of neoplasms at the original point of infection. Green shoots, measuring several centimetres, have been observed to develop from such tumours. Infection has been found on soil used exclusively for field crops for many years. The use of the Clapp's Favourite and Bose's Flaschenbirne varieties in grafting appears to increase the incidence of infection.

The writer's experiments in the control of the disease are very fully described, the results being discussed and presented in tabular form. The most promising method appears to consist in covering the still healthy, growing roots for 15 minutes with sandy loam to which a 0·5 per cent. solution of uspulun has been added. In some cases this treatment was efficacious also with infected trees after the excision of the diseased portions. Germisan (0·5 and 0·1 per cent.) applied in an admixture of sand also controlled the disease but caused severe injury to the plants. Soil disinfection with uspulun (19 to 60 gm. per sq. m.), though failing to prevent infection, greatly stimulated the growth and vigour of the trees, the increased production of fibrous roots being particularly marked in the case of the comparatively delicate pear stocks. Similar results were obtained with apples by soil disinfection with germisan (16 to 38 gm. per sq. m.) and 225 V, from the Saccharinfabrik, Magdeburg (30 to 60 gm.), while all these preparations, as well as A.Z. 3 (19 to 38 gm.), trockenbeize A.Z. III (60 gm.), and neusegetan (7·5 to 15 gm.) reduced the number and size of the tumours.

MUNCIE (J. H.). **Hairy root of Apple seedlings.**—Abs. in *Phytopath.*, xvi, 1, p. 78, 1926.

Three distinct types of hairy root have been observed on French apple seedlings, namely, (1) the woolly knot form, arising from a distinct gall; (2) the simple form described by Stewart; and (3) the type in which fine, fibrous roots arise in clusters from the tap root.

The first type is infectious and was induced artificially by inoculation with *Bacterium tumefaciens*, and by growing healthy seedlings in naturally and artificially infected soil. The second type was the least, and the third the most common, but the former occurred under sterilized conditions, and repeated attempts to isolate *Bact. tumefaciens* from the latter were unsuccessful, while histological studies failed to reveal the presence of an organism in or near the hairy roots. These two types, therefore, would appear to be non-pathogenic.

MUNCIE (J. H.). **The effect of crown gall on young Apple and Peach trees and longevity of Bacterium tumefaciens in the soil.**—Abs. in *Phytopath.*, xvi, 1, p. 79, 1926.

In 206 attempted isolations from 84 galled apple trees, *Bacterium tumefaciens* was recovered in only four cases. In 200 apple trees examined by longitudinal sections through the middle of the union, 81 per cent. of the healthy showed a perfect union of stock and scion, while 63 per cent. of the galled showed only partial continuity. The reduction in water flow through diseased Wealthy,

Salome, and Jonathan trees was 69·7, 21·7, and 47·2 per cent., respectively, the corresponding average reduction in peach trees being 82·4 per cent.

Typical crown gall developed on young tomato plants with wounded stems set in soil infested with *Bact. tumefaciens* up to 102 days after the soil was inoculated.

PETHERBRIDGE (F. R.) & DILLON WESTON (W. A. R.). **Observations and experiments on Apple scab in East Anglia.**—*Journ. Min. Agric.*, xxxii, 12, pp. 1119–1127, 1926.

The perithecial stage of the apple scab fungus [*Venturia inaequalis*] is stated to have been found in abundance in the spring of 1925 on fallen leaves of many varieties of apple in East Anglia, but in no case on dropped apples that persisted through the winter. Observations during 1924 and 1925 showed that certain varieties of apple [a list of which is given] appear to be more susceptible to twig infection than others. Although evidence seems to indicate that there is more twig infection on the heavier than on the lighter soils, in the Wisbech district (Isle of Ely) the fruit appeared to be more scabbed on light soils. The results of observations on the severity of attack by scab on 33 varieties of apple in 1924 and 1925 in the various counties of East Anglia are given in tabular form. The disease was economically controlled in 1925 on the Worcester Pearmain variety by spraying with either normal Bordeaux mixture, excess lime Bordeaux mixture, or lime-sulphur with or without lead arsenate. This variety was badly russeted by excess lime Bordeaux mixture in 1923 but not in 1925. The leaves of Lane's Prince Albert were seriously injured when sprayed once with one per cent. lime-sulphur after blossoming, except in cases where the trees had been also sprayed before blossoming with a 1 in 40 solution of lime-sulphur.

KEITT (G. W.). **Some relations of environment to the epidemiology and control of Apple scab.**—*Proc. Nat. Acad. Sci.*, xii, 2, pp. 68–74, 1 graph, 1926.

The writer's investigation of the relation of environment to the epidemiology and control of apple scab (*Venturia inaequalis*) comprised field and laboratory studies on the development and prevention of the disease under natural and controlled conditions in Wisconsin.

The field studies were facilitated by the establishment in the experimental orchards of a meteorological station equipped with special apparatus for the hourly recording of the data, and these have been correlated with a series of records bearing on significant aspects of the seasonal development of the fungus, the host, the disease, and the efficacy of control measures. The results of these investigations generally agreed with those of other workers as to the importance of the factors of moisture and temperature in the severity of the disease and on its amenability to control.

The laboratory experiments [the technique of which is briefly described] were conducted in specially constructed chambers in which air temperature and humidity were controlled [see this *Review*, i, p. 243]. The experimental plants were inoculated with

naturally discharged ascospores and held in the moist chamber at a temperature range of 6° to 30° C. Infection occurred at 6° to 26°. The periods necessary for infection were shorter at 9°, 15°, 20°, and 24° than at 6° or 26°, and indicated an optimal rate of progress of the initial stages of infection near 20°.

From the limited data available it would seem that the effect of temperature during incubation within the host tissues is parallel to its influence on the initial stages of leaf infection (i. e., up to the time the fungus becomes independent of an external supply of moisture). At 8° the incubation period was prolonged to 17 days compared with 8 to 12 days at 20° to 25°. At 26° the disease developed slightly after 13 days in one test and failed to appear in two. Four intermittent exposures of eight hours each at 31° during the incubation period somewhat impeded but did not preclude the development of the disease, while a single exposure of 24 hours to 31° to 32° also failed to prevent the appearance of the symptoms. This effect was produced, however, by similar exposures of 48 hours or more.

Few detailed data are available on the responses of the host plant to temperature, but its temperature range for active growth is evidently distinctly higher than that for the development of the fungus or the appearance of the disease.

The minimal period of continuous wetting necessary for leaf infection was six hours at 20° and 24°, compared with 18 at 6°. The fungus can readily tolerate brief periods of drying and exposure to direct sunlight during the early stages of infection under laboratory conditions.

The results of preliminary data on the relation between humidity and infection denote that ordinary fluctuations do not significantly affect the progress of the disease during the incubation period.

The outstanding results of field observations on the efficacy of fungicides in relation to environment are (1) the prevention of leaf infection by ascospores of *V. inaequalis* at 6° by commercial lime-sulphur and sulphur dust at the usual concentrations; and (2) the greater efficiency of these fungicides, under the conditions of the experiments, than of 4–4–50 Bordeaux mixture.

Spraying calendar for Apple orchards.—*Govt. of Northern Ireland, Min. of Agric., Leaflet* 33, 5 pp., 4 figs., 1926.

The spraying programme recommended for the control of scab [*Venturia inaequalis*] in apple orchards in Northern Ireland is as follows:

Winter spraying before growth has commenced (preferably in February) with a 5 per cent. solution of carbolineum. Summer spraying as follows—(1) before the blossoms open; (2) at petal fall (usually 18 to 21 days after the blossoms have shown most pink); (3) three weeks after the second spraying. Bordeaux mixture ($2\frac{1}{4}$–8–40) should be used for all three applications, and if capsids are present, 5 or 6 oz. nicotine sulphate or nicotine should be added to the mixture.

It is stated that Bordeaux mixture at the strength given above may safely be used on all the apple varieties grown commercially in Northern Ireland.

SHEAR (E. V.). **Field trials of spray materials on Apples in 1925.**—*Proc. New York State Hort. Soc.*, lxxi, pp. 145–150, 1926.

Good results were obtained in the control of bitter rot of Greening apples (*Glomerella cingulata*) by the application of Bordeaux mixture, beginning a fortnight after the blossom or calyx spray and continuing till mid-August. Copper sulphate was used at the rate $\frac{1}{8}$ to 4 lb. per 50 galls., and the mixture generally contained 25 per cent. more hydrated lime than copper sulphate. Very little foliage injury was observed. Diluted commercial lime-sulphur, dry-mix sulphur lime [see this *Review*, v, p. 311], atomic sulphur, vegetable sulphur, and colloidal sulphur may be recommended for summer sprays. The so-called Oregon cold-mix sulphur and lime [see this *Review*, iv, p. 485] is thought to be probably equal to dry-mix in efficacy.

In the control of scab [*Venturia inaequalis*] Bordeaux mixture 3–3–50, with the admixture of various oils, such as scalecide, sunoco, Target, and Rex oil emulsion, proved equally effective with 1 in 8 lime-sulphur. Directions are given for the preparation of Bordeaux oil emulsions. Both Bordeaux and lime-sulphur caused severe russeting of Ben Davis trees sprayed when the blossom buds were expanding to form clusters. Scab was reduced from 25 to 3 and 4 per cent., respectively.

OSTERWALDER (A.). **Schorfbekämpfungsversuche aus den Jahren 1915–1925.** [Scab control experiments in the years 1915–1925.]—*Zeitschr. für Pflanzenkrankh.*, xxxvi, 3–4, pp. 79–97, 1926.

The results of ten years' experiments in the control of apple and pear scab [*Venturia inaequalis* and *V. pirina*] at the Wädenswil [Switzerland] Experimental Station are described in some detail [see also this *Review*, iv, p. 295]. Bordeaux mixture at concentrations of 1, 1·5, and 2 per cent. caused severe scorching and other blemishes on apple foliage and fruit, followed by premature leaf fall, while the treated pears assumed a bluish-red tinge and a roughness of the skin (gooseflesh). These effects occurred irrespective of the strength of the mixture, the amount of hydrated lime used, and the varying degree of alkalinity of the solution.

Both apple and pear foliage were similarly damaged by 1·5 per cent. Burgundy mixture. Pear leaves treated with either of these preparations were much more heavily attacked by the pear sucker (*Psylla pyrisuga*) than the untreated foliage.

Cuprosan, a blue liquid of syrupy consistency with a smell of ammonia (Chem. Fabrik 'Flora', Dübendorf, near Zurich), produced injurious results on the treated apple and pear trees similar to those caused by Burgundy mixture.

On the whole, the lime-sulphur preparations were more efficacious than the copper mixtures. Lime-sulphur 1 in 30 or 1 in 40 generally caused little or no damage to apple foliage, but that of the treated pear trees was affected by concentrations between 1 in 30 and 1 in 50. At a strength of 1 in 80 the mixture gave good control of scab and caused little injury. In 1924 the trees were unusually susceptible, the 1 in 40 concentration causing scorching

and premature defoliation of apples, while pears were severely damaged even at a dilution of 1 in 100.

Both Bordeaux mixture and lime-sulphur caused extensive defoliation of apple trees which were severely infected by scab at the time of application. On varieties in which the fruit is more susceptible to scab than the leaves, e. g., Cellini and Boiken, the application of lime-sulphur may safely be deferred till between the middle of June and middle of July.

Solbar afforded adequate protection against scab, but its efficacy was scarcely equal to that of lime-sulphur.

Cosan [see this *Review*, iv, p. 106] proved ineffective at a concentration of 0·5 per cent.

Sulfosan, a sulphur mixture resembling lime-sulphur (Fabrik 'Flora'), applied on 13th May at 1 per cent., on 30th May at 1·5 per cent., and on 15th June at 2 per cent. strength, proved very effectual in the control of scab, and imparted a fresh green appearance to the treated foliage, which was retained till the middle of October.

Tegoschwefel, a sulphur dust supplied by Wander & Co., Berne, did not give satisfactory results.

The application of a concentrated lime-sulphur spray (1 in 2) during the dormant period failed to prevent subsequent scab infection and did not render the summer treatment superfluous. The latter, however, appeared to be more efficacious when preceded by a winter spray.

WALLACE (T.) & MANN (C. E. T.). **Investigations on chlorosis of fruit trees. I.—The composition of Apple leaves in cases of lime-induced chlorosis.**—*Journ. Pomol. and Hort. Science*, v, 2, pp. 115–123, 1926.

The present paper gives certain results obtained by the authors in their study of the so-called accidental chlorosis of fruit trees (i. e., of the chlorotic condition which is induced by environmental factors, such as particular soil conditions), with special regard to the composition of green and chlorotic leaves of apple. The data obtained from samples of leaves collected under various conditions indicate that the salient differences between healthy and diseased leaves in all cases are: green leaves, as against chlorotic leaves, contain higher percentages of dry matter and lower percentages of ash in the dry matter; the calcium content of their ash is much higher, while the percentages of potassium and sodium, especially of the former, are much lower. The differences in the amounts of magnesium, iron, aluminium, phosphorus, and silica are not so definite in character as in the case of calcium, potassium, and sodium. Data are presented in a tabular form to show the composition of the soils on which the cases of chlorosis considered were found. All contained high percentages of carbonates, which is stated to be by far the most common feature of soils associated with chlorosis in England.

THOMAS (H. E.). **Root and crown injury of Apple trees.**—*Cornell Agric. Exper. Stat. Bull.* 448, 9 pp., 1926.

An account is given in this paper of the occurrence in the apple

orchards of New York, of a non-parasitic type of root and collar injury which has caused serious losses in many cases. In affected trees the foliage becomes pale and sparse, and terminal growth of the shoots is reduced. The fruit is small and poor, and the bark of the branches is sometimes reddened and cracked. On the collar and the upper lateral roots near the base of the trunk the bark is usually destroyed and tends to peel off in shreds. The underlying wood usually remains brown and firm until the tree dies, death being very gradual as a rule. No pathogenic organism has been found constantly associated with this type of injury, but isolations from injured tissues showed that two fungi are able to cause decay in the bark and wood of roots already suffering from the diseased condition, namely, *Xylaria polymorpha* and *Hypholoma sublateritium*.

Inoculation experiments indicated that, on young trees, *X. polymorpha* penetrates the living tissues very slowly, whereas *H. sublateritium* was unable to attack healthy roots, though able to kill the bark and wood of already injured trees.

The initial cause of the greater part of the root and crown injury described is thought to be low temperature.

The control measures recommended are based on the improvement of orchard practices, especially such as promote the development of a deeper and more vigorous root system. Approach grafting with apple seedlings and with scion-rooted McIntosh and Delicious stock has given promising results in aiding the recovery of injured trees.

OSKAMP (J.). **Apple scald.**—*Proc. New York State Hort. Soc.*, lxxi, pp. 191–196, 1926.

The symptoms of apple scald [see this *Review*, iv, p. 676] are described and discussed in relation to maturity and ventilation. A marked reduction of the disease was obtained by the use of oiled wrappers or shredded oil paper at the rate of $1\frac{1}{2}$ lb. per barrel. There was no difference between the efficacy of the two methods when the paper was used in equal amounts by weight.

PLAGGE (H.). **Soft-scald and breakdown of Apples as affected by storage temperature.**—*Proc. Amer. Soc. Hort. Sci. 1925*, pp. 58–66, 1926.

Contrary to the opinion of Kidd and West [see this *Review*, iv, p. 173], the writer regards soft scald and internal breakdown of apples as belonging to two distinct classes of disease [see also this *Review*, iv, p. 676].

The experiments described in the present paper were carried out with Grimes and Jonathan apples under controlled conditions near Ames, Iowa. The fruit was stored at intervals ranging from immediately after picking to three weeks later. The storage temperatures employed were 30°, 32°, 34°, 36°, and 40° F. One lot of fruit was placed in an air-cooled storage house where the minimum temperature was 29° (in January) and the maximum 60° (in October). The relative humidity of the cold-storage rooms was maintained between 80 and 85 per cent.; while that of the air-cooled storage house ranged from 60 to 98 (average 65).

On examination of the fruit in January internal breakdown was

found to be very severe (11·2 to 58·3 per cent.) at temperatures of 30° and 32° on Grimes, while it was entirely absent at 34°, 36°, and 40°. In the fruit held under air-cooled storage conditions, where the temperature range was much higher during October and November, internal breakdown was not observed as late as March. These results suggest the existence of two types of breakdown, one occurring early in the storage season as a consequence of too low a temperature, and the other developing later in connexion with physiological deterioration.

In the former type of breakdown the affected tissues present a soggy and watery appearance, and their texture somewhat resembles that of baked apples. The latter type of breakdown is characterized by a mealiness of the tissues which is generally recognized as the result of progression in the ripening processes. This condition frequently develops in fruit stored for a considerable period at excessively high temperatures or in an over-ripe condition. Large apples appear to be more susceptible than small ones to this type of breakdown, which may be associated with watercore and bitter pit.

Variations in orchard practice were found to exercise less effect on the incidence of breakdown in Grimes than slight temperature fluctuations throughout the storage period.

Severe soft scald of Jonathans also occurred at 30° and 32° (up to 42·3 per cent.), and seems to be correlated with low temperature conditions. The conditions with regard to soft scald on Jonathans are similar to those of the soggy type of internal breakdown on Grimes. A fortnight's delay, or more, in storage usually reduced soft scald to a minimum at 32°, but under these conditions Jonathan spot [loc. cit.] was very prevalent. The comparative rarity of soft scald on Jonathan apples from western orchards may be due to the delay undergone by such fruit before storage.

The possibility of controlling soft scald and the soggy type of breakdown by a slight increase in the ordinary storage temperatures is suggested.

Harrison (J. E.). **The Jonathan Apple in cool storage.**—*Journ. Dept. Agric. Victoria*, xxiv, 1, pp. 31–38, 3 figs., 1926.

The writer describes the results of a series of experiments in the effect of temperature and maturity on the keeping quality of Jonathan apples from different parts of Victoria in cold storage [see preceding abstract]. Soft scald was found to occur at 32° and 34°, but not at 37° F., while internal breakdown was also more severe at the former temperatures. Fungous decay and Jonathan spot, on the other hand, developed more profusely at the higher temperatures.

Fruit from lightly cropped trees was not found to be specially susceptible either to soft scald or internal breakdown. It was noteworthy that soft scald occurred in early storage and internal breakdown in late. No difference was observed in the keeping quality of apples from exposed and shady portions of the same tree. As a result of trials of the effect of maturity on keeping quality, growers are recommended not to pick green fruit, and once the fruit is ripe, not to allow it to remain on the trees.

The results of a comparative examination of apples affected by Jonathan spot in storage and those remaining healthy suggest that exposure to the sun may unduly increase the porosity of the lenticels, thereby affording admission to harmful substances.

Satisfactory results have been obtained in preliminary tests in the commercial use of a temperature of 37° in the Harcourt and Croydon Co-operative Cool Stores.

PENTZER (W. T.). **Color pigment in relation to the development of Jonathan spot.**—*Proc. Amer. Soc. Hort. Sci. 1925*, pp. 66–69, 1926.

Jonathan spot [see preceding abstracts] is estimated to affect 13·1 per cent. of the average annual boxed apple crop, chiefly of the red Jonathan and Esopus varieties, in the United States. The results of a histological study of the skin of affected apples showed that the pigment of the subepidermal cells (normally red) was of a bluish-brown colour in the spotted regions, and this condition was found by colorimetric determinations to be associated with a deficiency of acid (P_H 4·7 compared with 2·8 for normal tissue). It is suggested that the normal acidity of the colour-bearing region may be maintained by the use of paper wrappers impregnated with various harmless acids.

Spray calendar for Apples and Quinces.—*New Jersey Agric. Exper. Stat. Circ.* 180, 4 pp., 1 fig., 1926.

This schedule supersedes that recommended in Circular 173 of the New Jersey Agricultural Experiment Station [see this *Review*, iv, p. 746] for the control of various fungous diseases of apples and quinces. In addition to the previous programme, two further sprays are advised, namely, (1) four to five and (2) ten to eleven weeks after petal fall: dry-mix sulphur lime [see this *Review*, v, p. 311] plus 3 lb. lead arsenate paste or 1½ lb. lead arsenate powder.

Spray calendar for Plums and Cherries.—*New Jersey Agric. Exper. Stat. Circ.* 182, 4 pp., 1 fig., 1926.

This schedule supersedes that recommended in Circular 165 of the New Jersey Agricultural Experiment Station. A. Plums. (1) Before the buds swell: commercial lime-sulphur 1 in 9 or home-made lime-sulphur (sp. gr. 1·03). (2) Immediately after petal fall: dry-mix sulphur lime [see this *Review*, v, p. 311] plus 3 lb. lead arsenate paste or 1½ lb. lead arsenate powder per 50 galls. of mixture. (3) When the fruit is the size of small green peas: same as (2). (4) Three weeks after (3): dry-mix sulphur lime. This programme aims at the control of black knot [*Dibotryon morbosum*], brown rot [*Sclerotinia cinerea*], and insect pests.

B. Cherries. (1), (2), and (3) As for plums. (4) After the fruit is picked: lime-sulphur 1 in 40. (5) and (6) A fortnight and five weeks after (4): same as (4). Self-boiled lime-sulphur or dry-mix sulphur lime may be substituted for commercial lime-sulphur in (4), (5), and (6). The diseases to be controlled are leaf spot [*Coccomyces hiemalis*] and brown rot.

BROOKS (F. T.). **Recent investigations on silver-leaf disease.**—*Journ. Min. Agric.*, xxxii, 12, pp. 1128–1133, 1926.

This is a condensed reproduction of Brooks's and Moore's report of their investigations of the silver-leaf disease [*Stereum purpureum*] of fruit trees in England [see next abstract].

BROOKS (F. T.) & MOORE (W. C.). **Silver-leaf disease. V.**—*Journ. Pomol. and Hort. Science*, v, 2, pp. 61–97, 1 fig., 1926.

This is a detailed report of work on silver-leaf disease (*Stereum purpureum*) conducted since 1922 [see this *Review*, iii, p. 343]. The statement is made that during this period many new shrubby hosts have been found, and attention is called to a slight increase of the disease on roses, especially ramblers. A few additional cases have also been observed on pears in England, but the disease is still very rare on this host. A comparatively new variety of plum, Purple Egg, is stated to be resistant.

While artificial inoculations of cut twigs with spore emulsions were successful throughout the year under laboratory conditions, experiments on freshly exposed surfaces in the field failed to produce infection during the months of June, July, and August, though successful during the rest of the year. Examination of the twigs which failed to respond to inoculation during these three months showed that the fungus spores had germinated, and that the mycelium had penetrated to a distance of about half an inch; its further progress had been stopped by the rapid formation of a barrier of gum below the exposed surface, probably due to some special physiological condition of the twigs during these months [see next abstract]. Experiments were also made throughout the year to test the ability of the spores to infect woody tissues after varying periods of exposure. It was ascertained that while *S. purpureum* readily infects woody tissues immediately after exposure, infection occurs with great difficulty on exposures of a month's standing, and is practically impossible on exposures over three months old. It is pointed out that woody tissues, soon after wounding, inevitably become invaded by a variety of micro-organisms which rapidly multiply and, in the authors' view, eventually oppose an effective barrier to the successful establishment of a fungus with parasitic proclivities like *S. purpureum*. It is believed that there is but little danger of this fungus following in the wake of an attack on plum trees by *Sclerotinia cinerea*, *Diaporthe perniciosa*, or *Cytospora* spp. Infection experiments with *S. purpureum* through leaf scars and lenticels were entirely without success.

In the light of the above results, the authors consider that the cutting out of the dead wood or silvered branches, where the latter is advisable, and also the thinning out of fruit trees, should be done during the early part of the summer, not later than the 15th of July. The advisability of cutting out silvered branches of fruit trees is, in a great measure, dependent on their condition. In vigorously growing trees it is usually preferable to let such branches stand until they have begun to die back, as observations have shown that the amount of natural recovery from the disease is greater than was formerly supposed, even in such susceptible varieties of plums as Victoria and Czar, and a correlation was

found between recovery and the vigour of the trees. The immediate cause of natural recovery is the formation [described in a separate chapter] of a 'gum barrier' in the tissues which checks the further growth of the fungus.

Tests were made of various preparations in use for dressing wounds in fruit trees. The best results were obtained with soft grafting wax and with home-made red oxide or white-lead paints, the preparation of which is indicated. Gas tar and Stockholm tar were shown by further experiments to be unsatisfactory as protectives against silver leaf. Experiments also showed that ring-barking the silvered trees is not a reliable treatment. In experiments conducted to test the effect of various fertilizers on the disease, applications of basic slag and kainit were found to be beneficial in some instances. The general treatment of the disease should include all measures tending to assure proper plant sanitation and a vigorous growth of the trees, special attention being given to a careful selection of land and of the young trees. A method is also described by which health in silvered trees may be regained by stimulating the growth of branches arising lower down the tree than those badly affected by the disease.

A number of experiments [details of which are given] showed that by injecting the culture fluid of *S. purpureum* into healthy trees, some of the symptoms associated with the later stages of silver-leaf disease were reproduced, thus indicating that the fungus secretes some substances which, apart from the living organism, may give rise to these symptoms.

SWARBRICK (T.). **The healing of wounds in woody stems.**—*Journ. Pomol. and Hort. Science*, v, 2, pp. 98–114, 1 pl., 7 figs., 1926.

The author's histological study of the process of natural healing of artificial wounds in woody stems [full details of which are given] showed that wounds made in the period from May to August inclusive were the most rapid in blocking their xylem tissues against the entry of disease organisms, which is in accord with the observations that have been made in regard to infection in the case of the silver-leaf disease of fruit trees [see this *Review*, iii, p. 279 and preceding abstract]. The evidence so far accumulated is thus strongly in favour of the practice of summer as against winter pruning.

PETHERBRIDGE (F. R.). **Notes on silver-leaf.**—*Journ. Pomol. and Hort. Science*, v, 2, pp. 141–147, 2 pl., 1926.

In the first part of the present paper a method is described by which a plum grower in the east of England was successful, while obtaining heavy crops of fruit, in keeping down the incidence and severity of silver-leaf disease [*Stereum purpureum*] in his orchard, part of which consists of about 400 trees of Victorias on Myrobalan stock. In the early years of growth the trees were trained so as to ensure the production of big branches which are now capable of bearing heavy crops without breaking. The soil is kept clean from weeds by tillage, and a good dressing of farmyard manure is applied in the autumn after a heavy crop, followed in the early spring by

a dressing of dissolved bones at the rate of 7 cwts. per acre. When the next heavy crop is well set, a late spring dressing is given of artificial fertilizers containing ammonia and phosphates. Silvered branches, even if bearing fruit, are removed before the middle of May, when very few spores of the fungus are present; this has also the advantage of promoting the formation of midsummer shoots with which to begin rebuilding the tree at once. When possible, the silvered branch is cut back to a healthy lateral, but if no such lateral is available, a one- to two-foot-long stump of the branch is left, in the hope that adventitious shoots may arise from the stump. Particular care is taken to protect the trees from unnecessary injuries when picking the fruit.

Of 22 young Czar plums planted in 1920 to replace the silvered trees removed, none has so far died, and only one has shown silvering; this indicates that there is very little danger of the young plums becoming infected from the previous trees, provided the latter are removed and burnt. Out of 129 Victoria plums grafted on common plum stock (found growing wild in the neighbourhood), none has died of the disease, although the foliage of a few was occasionally silvered.

In the second part of the paper it is pointed out that of recent years injury to apple trees from silver leaf has considerably increased in the east of England, the most susceptible varieties being Early Victoria (Emneth Early), Lord Grosvenor, and Newton Wonder. Even in orchards containing no obvious immediate source of infection, such varieties are liable to heavy attacks if large branches are removed.

ANDERSON (H. W.). **Control of bacterial spot of Peach with sodium silicofluoride.**—Abs. in *Phytopath.*, xvi, 1, p. 79, 1926.

Spraying experiments for the control of bacterial spot or shot hole of peach [*Bacterium pruni*: see this *Review*, iv, p. 356] conducted at Urbana, Illinois, in 1925, demonstrated the possibility of control with a solution of sodium silicofluoride, which had proved effective, in laboratory tests, in preventing growth in broth cultures in dilutions of 1 in 3,000. Satisfactory results were given by seven applications, at intervals of 10 to 14 days, of this preparation at a strength of 2 lb. in 50 galls. of water. The controls showed 10 to 90 per cent. infection on 1st October, while very little was observed on the treated trees. No injury to the foliage was caused by the sodium silicofluoride treatment, but copper sprays, including two brands of colloidal copper and Bordeaux mixture, produced severe spray injury.

Spray calendar for Peaches.—*New Jersey Agric. Exper. Stat. Circ.* 181, 4 pp., 3 figs., 1926.

This schedule, aiming at the control of leaf curl [*Taphrina deformans*], scab [*Cladosporium carpophilum*], and brown rot [*Sclerotinia cinerea*], is substantially identical with that recommended in Circular 174 of the New Jersey Agricultural Experiment Station [see this *Review*, iv, p. 746].

RANKIN (W. H.). **Raspberry mosaic control in Hudson River Valley.**—*Proc. New York State Hort. Soc.*, lxxi, pp. 173–178, 1926.

Reverting to the mosaic eradication experiments of 1923 [see this *Review*, iv, p. 176], the writer attributes the comparative failure of roguing in the Hudson River Valley primarily to the fact that the susceptible Cayuga and Seneca varieties were used for testing the method. Inadequate knowledge concerning the nature and extent of insect transmission was among the other factors militating against its success. The extended cultivation the resistant varieties Cuthbert, June, Ontario, and possibly of Newman, is recommended.

GARBOWSKI (L.) & LESZCZENKO (P.). **Zraszanie Agrestu przeciw mączniakowi amerykańskiemu (Sphaerotheca mors-uvae Berk. et Curt.).** [Treatment of Gooseberry against American mildew (*Sphaerotheca mors-uvae* Berk. et Curt.).]—*Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], *Warsaw*, i, 4, pp. 12–21, 1925. [French summary. Received April, 1926.]

The results of a series of experiments made in 1924 at the School of Agriculture at Swiecie [Schwetz], Poland, on the control of the American mildew (*Sphaerotheca mors-uvae*) of gooseberry, indicated, in accordance with the results previously obtained by the senior author in the Crimea [see this *Review*, ii, p. 69], that the disease is best controlled by weak solutions (0·01 to 0·02 per cent.) of arsenate or arsenite of soda applied after the setting of the fruit; spraying the bushes before the bursting of the buds did not control the disease to any appreciable degree. Among the other preparations tested the next best results were obtained with a 0·2 per cent. solution of caustic soda, which did not cause any injury to the leaves. Burgundy mixture gave much less reliable results, and a 1 per cent. solution of carbonate of soda gave practically no control. The injury to the leaves caused by the arsenical salts may be minimized by avoiding spraying the bushes during unfavourable conditions, such as wet weather.

It is stated that in 1925 *Sphaerotheca mors-uvae* was exceptionally heavily parasitized by *Cicinnobolus cesatii*, which is endemic in the locality.

LAUBERT (R.). **Die Gloeosporium-Fäule der in Deutschland gehandelten Bananen.** [The *Gloeosporium* rot of Bananas on the German markets.]—*Mitt. Gesellsch. Vorratsschutz*, ii, 2, pp. 19–21, 1926.

A brief popular account is given of the fruit rot of bananas caused by *Gloeosporium musarum* [see this *Review*, iv, p. 103] which is stated to be very prevalent in consignments supplied to the German markets from Jamaica and elsewhere. In 1910 the writer expressed the view (*Gartenflora*, lix, p. 409) that the causal organism of this decay in Germany is a distinct biological form of the fungus and proposed the name *G. musarum* var. *importatum* (spores 9 to 24 by 5 to 7 μ). Subsequently it has been suggested that the organism in question is identical with, or very closely related to, *G. fructigenum* f. *americana*.

Bunchy top—what it is, how to detect it, what to do.—*Queensland Agric. Journ.*, xxv, 3, pp. 259-268, 9 pl., 1926.

In this paper, compiled by the Bunchy Top Investigation Committee, the principal available information on the etiology, symptoms, and control of bunchy top of bananas [see this *Review*, v, p. 310], under Queensland conditions, is summarized and presented in a popular form. The role of the dark banana aphis [*Pentalonia nigronervosa*] in the transmission of the disease is explained. During January, 1926, bunchy top was found in the area between the Brisbane and Caboolture Rivers, from which district suckers have recently been sent to all parts of Queensland. Moreover, the disease is now present in all plantations inspected, both north and south of the Caboolture River, which received suckers from the infected area as far back as 1923. Full directions are given for the detection of the disease and a proclamation of 21st January, 1926, prohibiting the movement of infected suckers, is reprinted.

HORNE (W. T.). **Preliminary notes on Avocado fruit decay.**—Abs. in *Phytopath.*, xvi, 1, p. 80, 1926.

Ripe fruits of avocado [*Persea gratissima*] are stated to be subject to a wound decay due to *Rhizopus nigricans*, the mycelium of which is also capable of slowly penetrating the sound surface. The seed is not injured. An active dark rot, sometimes accompanied by dry decay of the seed, is caused in Florida by a fungus probably identical with *Diplodia natalensis*, while *Colletotrichum gloeosporioides* and *Pestalozzia* sp. are also conspicuous in decaying fruits in this region. California fruits decay mainly as a result of infection by species of *Alternaria*, *Cladosporium*, *Fusarium*, and other moulds. The rots produced are slow acting and rather dry. Bacteria are abundant in late stages of decomposition.

SMITH (C. O.). **Blast of Avocados—a bacterial disease.**—*California Citrograph*, xi, 5, p. 163, 1 fig., 1926.

A new fruit blemish of the avocado [*Persea gratissima*], apparently due to the organism responsible for citrus blast (*Pseudomonas citriputeale*), was investigated in California in 1925. The fruit exhibited a marked cracking, especially near the blossom end, and definite brownish or black, irregular or nearly circular spots were situated near or round the lenticels. At maturity the lesions, which are purely superficial, measure $\frac{1}{8}$ to $\frac{1}{4}$ inch or more in diameter.

The causal organism was isolated from two lots of Knight avocados and inoculated into lemons with positive results. Inoculations through wounds on the succulent twigs and unripe fruit of a seedling avocado produced the typical symptoms of the disease. Cultures of *P. citriputeale* from oranges also gave positive results on avocados. A superficial, dark leaf spot was produced by brushing the blast organism either from citrus or avocado on to the under side of avocado leaves.

The disease is reported to occur along the foothills from Pasadena to Glendora, at North Whittier Heights, East Whittier, and perhaps elsewhere. The Knight variety appears to be most sus-

ceptible, Taft also being severely affected in certain localities, while Fuerte seems to be resistant.

Skinner (J. J.) & Demaree (J. B.). **Relation of soil conditions and orchard management to the rosette of Pecan trees.**—*U.S. Dept. of Agric. Bull.* 1378, 16 pp., 8 pl., 1926.

In this bulletin, a description is given of experiments in soil treatment carried out on two orchards badly affected with pecan rosette [see this *Review*, i, p. 440] in Georgia, in order to study the effect of soil conditions and of fertilizers of various composition on the disease.

The results obtained in one of the orchards showed that ploughing, thorough cultivation, and the growing and turning in of two green manure crops each year was followed by a gradual improvement, resulting in the apparently complete disappearance of all rosette symptoms and a return to the normal production of nuts. In the other orchard, where ploughing was omitted and the land only submitted to a single light disc treatment annually, the grasses and weeds being allowed to grow and removed later as hay, a marked increase in the symptoms of rosette was observed.

A close correlation was found, as a result of soil examination, between soils having a high nitrogen and organic matter content and productive non-rosetted trees, while the trees growing in soil with low nitrogen and organic matter were liable to be rosetted.

No evidence was obtained in regard to the influence of particular fertilizers on the disease.

Széll (L. v.). **Einfache Darstellung von feinstäubigem Kupferkalk- und Kupferschwefelpulver auf nassem Wege.** [Simple preparation of copper-lime and copper-sulphur dust by a liquid method.]—*Fortschr. der Landwirtsch.* [Vienna], i, 8, pp. 256–257, 1926.

Directions are given for the preparation of two dusts suitable for general use in the orchard and vineyard for the control of various fungous diseases, e.g., *Plasmopara viticola*, *Exoascus* [*Taphrina*] *deformans*, *Fusicladium*, *Phytophthora*, and the like. Copper-lime dust should be made in a barrel with a volume of 1 to 1·5 hectol., in which 20 kg. of lime, composed of particles the size of a hazel-nut, and 20 kg. of crystallized, coarsely ground copper sulphate are stirred with 3 l. of warm well water, the resulting mixture being put through a sieve of 100 to 120 mesh. The addition to this mixture of 30 to 50 per cent. of finely granular sulphur (60° to 70° Chancel) will produce a satisfactory copper-sulphur dust.

Shear (C. L.) & Clements (F. E.). **The condition and needs of systematic mycology.**—*Science*, N.S., lxiii, 1633, pp. 393–395, 1926.

After a brief discussion of the economic and scientific significance of mycology, the writers attempt to account for the dearth, especially in America, of investigators and students of the taxonomy of the fungi. Among the reasons for the scarcity of workers in this wide field are mentioned the lack of sufficient reliable and attractive

textbooks and monographs on the subject; the inconsistency and irregularity in the use of Latin names; and the continuous subdivision and duplication of genera and species. The existing fundamental differences of opinion as to the settlement of nomenclatorial problems could, in the writers' view, be resolved by adherence to general usage, the names to be adopted being determined by a committee of systematic mycologists. Such a committee would also restrict the constant multiplication of genera and species.

STEVENSON (J. A.). **Foreign plant diseases. A manual of economic plant diseases which are new or not widely distributed in the United States.**—*U.S. Dept. of Agric., Fed. Hort. Board,* Washington, Govt. Printing Office, 198 pp., 1926.

This publication, which has been prepared primarily to assist officers of the United States Federal Horticultural Board in the enforcement of plant quarantines, is based on the data contained in the host index of foreign plant diseases, comprising several hundred thousand entries, maintained in the Office of Foreign Plant Quarantines of the Federal Horticultural Board. An alphabetical arrangement, according to their scientific names, has been followed both for the hosts and the causal organisms of the diseases thereunder. Species of parasitic fungi or bacteria known to occur more or less widely in the United States have been excluded, but some reported from restricted areas are included in order to guard against further importation. A few fungi of major importance and comparatively recent introduction, e. g., *Endothia parasitica*, the cause of chestnut blight, and *Cronartium ribicola*, which is responsible for white pine blister rust, are also listed. Under each fungus or bacterium included in the survey is given a very brief summary of the symptoms of the disease produced by it, together with its specific hosts and distribution. The nomenclature is stated to follow current usage in the United States. Common names of the host plants are generally given, in addition to the scientific names.

The list forms a useful index to the more important parasitic fungi found outside the United States on a number of cultivated and wild plants of economic importance.

BUCHHEIM (A.). **Phytopathologische Forschung und Schädlingsbekämpfung in der Sowietunion Russland.** [Phytopathological research and pest control in Soviet Russia.]—*Angew. Bot.*, viii, 1, pp. 1–7, 1926.

After a cursory review of the development of phytopathological research in Russia since Woronin's discovery of the heteroecism of *Sclerotinia* in the early seventies of the last century, the author outlines the present organization of the plant protection service in Soviet Russia, headed by the Section for Plant Protection (Ozra) of the Commissariat for Agriculture. In most of the capital towns of the various governments in the Union are instituted Plant Protection Stations (each comprising a section for mycology and a section for entomology), staffed by specialists and practical instructors. The latter are sent into the various districts to guide and help the agriculturists in the control of pests and diseases, their chief activity

being at the present time directed towards the popularization of cereal seed treatment against the various smuts which have attained a threatening extension in the country. As an example of the results attained by this propaganda, the statement is made that while in 1924 only about 85,000 tons of cereal seed were treated against smut, in 1925 this figure rose to over 130,000 tons (about 2 per cent. of the total used in that year).

Besides Plant Protection Stations, there also exist in Moscow and in the provinces Phytopathological Experiment Stations engaged on more purely scientific research. Of particular practical interest is the work done at the Kharkoff Experiment Station in regard to the effect of stable manure on the incidence and severity of cereal smuts. It was conclusively shown that while in the early stages of growth of the various cereals the number of infected plants was increased in manured plots, in the final result the incidence of smut was decreased owing to the more vigorous development of the plants, which allowed them to outgrow the smut mycelium present in their tissues. Interesting also is Spangenberg's investigation [already noticed from another source; see this *Review*, v, p. 153] on the relative resistance of spring wheats to *Tilletia tritici*. In Piatigorsk [government of Terek, Caucasus] A. I. Lobik investigated the relation of the spore charge per wheat grain in seed samples to the severity of attack of the crop by *Tilletia*, and believes that up to 500 spores per grain the attack is mild, from 500 to 2,500 spores the attack is of average severity, and with over 2,500 spores the attack is severe.

Of recent years reports have been sent from some regions recording the occurrence of a strain of *Tilletia secalis* on rye which was shown not to be able, under natural conditions, to pass from rye to wheat. It would appear that this form requires particular conditions for its development, probably in relation to spore germination, which it does not find in the wheat crop in the localities where it occurs.

JOHNSON (J.). **Mosaic diseases on differential hosts.**—*Phytopath.*, xvi, 2, pp. 141–149, 5 pl., 1926.

In this paper evidence is presented that at least five distinct types of mosaic may occur on tobacco, tomato, and other members of the Solanaceae, excluding potatoes, which form the subject of a separate investigation [see also this *Review*, v, p. 314].

The four additional mosaics are (1) cucumber mosaic, (2) petunia mosaic, (3) speckled tobacco mosaic, and (4) mild tobacco mosaic. The tobacco seedlings used in the experiments were grown in fertile soil at 27° to 32° C. and were generally inoculated by means of needle punctures. The incubation period was found to be shortest for ordinary tobacco mosaic (which was used for comparative purposes), somewhat longer for petunia and speckled tobacco mosaic, and longest for cucumber and mild tobacco mosaic. The average percentage of infection was highest with ordinary and speckled tobacco mosaic (84 out of 85 and 91 out of 100, respectively) and lowest with cucumber (57 out of 105). Ordinary tobacco mosaic retains its infectiveness for years [see this *Review*, v, p. 194], whereas that of cucumber mosaic is usually limited to less than

two days in liquid tobacco extract and to two or three weeks in slowly drying leaves. Petunia mosaic is similar to cucumber mosaic in this respect, while the speckled tobacco mosaic is considerably more resistant to adverse conditions.

The symptoms of these five mosaics are quite distinct on tobacco seedlings, except in the case of petunia and speckled tobacco mosaic, which appear to produce an almost identical condition. The viruses of these two forms of mosaic can be differentiated on *Nicotiana glutinosa* [see this *Review*, v, p. 140], petunia, pokeweed [*Phytolacca decandra*], and probably on *Physalis*, as well as by their comparative longevity outside the host. The viruses of petunia and cucumber mosaic are best distinguished on *N. rustica*, tomato, and petunia.

Tobacco mosaic was found to produce symptoms on a new host, *Solanum rostratum*, and to cause conspicuous lesions on the wounded stems of *Datura stramonium*, potato, pepper, and other plants. *N. glutinosa* and *N. rustica* were sometimes killed by these stem lesions, though there were no symptoms of mosaic in the foliage of the former. *N. glauca* was distinctly stunted but with little or no mottling as a result of infection by tobacco mosaic. Eggplants [*S. melongena*] were only infected by this mosaic with difficulty and seldom showed mottling, though stunting and stem or leaf necrosis were marked in young plants.

Cucumber mosaic usually produces larger chlorotic areas on tobacco than ordinary tobacco mosaic, especially near the tips of young leaves. The symptoms of this virus on *N. glutinosa* consist chiefly of mottling and malformation. Tomato foliage infected by cucumber mosaic develops a characteristic malformation known as 'maiden-hair fern' type of leaf. Petunia and pokeweed appear to be specially susceptible to cucumber mosaic and the former also to the speckled tobacco mosaic. On *N. glauca* the mottling which develops as a result of infection with speckled tobacco or petunia mosaic is very faint and sometimes accompanied by a scattered purplish tint.

Mild mosaic on tobacco is so readily masked that the symptoms often disappear and reappear intermittently. On *N. rustica*, however, decided malformation may occur, while *N. glutinosa* may be killed without mottling. Very marked symptoms developed on *Physalis*, which may be regarded as a good differential host for this type of mosaic.

MASUI (K.). **A study of the mycorrhiza of Abies firma, S. et Z., with special reference to its mycorrhizal fungus, Cantharellus floccosus, Schw.**—*Mem. Coll. Sci., Kyoto Imper. Univ.*, Ser. B, ii, 1, pp. 15–84, 4 pl., 26 figs., 10 diags., 1926.

In 1923 the writer observed *Cantharellus floccosus* growing on the mycorrhizal roots of a fir tree (*Abies firma*) near Kyoto, Japan.

The fructifications of the fungus were found to originate (1) directly on the infected roots of the tree; (2) at the termination of the mycelial strands developing from the infected roots; (3) on a mycelial network interwoven by the hyphae projected from numerous small

mycorrhiza; and (4) occasionally as a lateral branch of an old fruiting body.

A histological examination of the mycorrhizal root revealed the presence not only of a fungous mantle and Hartig's network, but also of intracellular hyphae..

The fungous infection on young roots is thought to be possibly due to the hyphae and mycelial strands given off from the pre-existing mycorrhiza as well as to those developing from the spores. Young roots branching off from the infected mother-root may be directly infected by the mycelium of the mantle.

The rate of growth of the main lateral roots of *A. firma* was shown to be diminished by infection with *C. floccosus*, which sometimes proves fatal to 60 to 90 per cent. of the roots during July and August.

Very detailed evidence is given to support the view that the fungus is parasitic.

Generally speaking, the dimensions of the fructifications are proportionate to the size of the roots from which they develop. They do not occur under or near young fir trees on account of the depth of the roots in the soil, and they are not found in damp soil. The presence of *C. floccosus* is an indication of the localization of the growing roots of *A. firma* in the superficial layers of the soil.

The macroscopic and microscopic characters of *C. floccosus*, which also forms mycorrhiza on *A. mayriana*, are described in detail.

PETRESCU (C.). **Contribution à l'étude de l'association biologique de quelques espèces de Papilionacées (Légumineuses) avec des espèces de champignons du genre Uromyces.** [Contribution to the study of the biological association of some species of Papilionaceae (Leguminosae) with species of fungi of the genus *Uromyces*.]—*Comptes rendus Soc. de Biol.*, xciv, 10, pp. 717–720, 1926.

In continuation of his previous researches [see this *Review*, iii, p. 474] the writer gives notes on the biological equilibrium established in the case of *Uromyces fabae* on *Vicia villosa*, *V. sativa*, *V. tenuifolia*, and *V. sepium*, the host being somewhat injured in the first three cases; of *U. pisi* on *Pisum sativum*, *Lathyrus pratensis*, and *L. tuberosus*, in which, when the fungus developed on the calyx of infected pea plants, the germination of the seeds was prevented except in richly manured soils, while the general biological equilibrium was more or less disturbed in the case of *L. tuberosus*; and of *U. loti* on *Lotus corniculatus* and *L. tenuifolius*, both of which were injured.

PIEKARSKI (A.). **Rak ziemniaczany w Województwie Śląskiem w roku 1925.** [Wart disease of Potatoes in the province of Silesia in 1925.]—*Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], *Warsaw*, i, 4, pp. 1–11, 1 map, 1925. [German summary. Received April, 1926.]

This is a detailed report on the occurrence of potato wart disease [*Synchytrium endobioticum*] in Polish Silesia, based on a careful survey made in 1924 and 1925. So far, the disease has been

discovered only in the districts of Katowice and Rybnik, in small-holdings and labourers' gardens in the neighbourhood of industrial towns, where potatoes are cultivated year after year on the same land. In all, 96 fields of a total area of about 28 hectares have been found to be infected, the intensity of infection varying from traces in one locality to 100 per cent. in Brzezie, which, together with Paruszowice, is the most important centre of infection.

Miscellaneous notes. Trials of Potatoes for immunity from wart disease, 1925.—*Journ. Min. Agric.*, xxxii, 12, pp. 1151–1153, 1926.

The annual trials of new varieties of potato in regard to their immunity from wart disease [*Synchytrium endobioticum*] were continued in 1925 by the National Institute of Agricultural Botany, at Ormskirk, Lancashire. The results were considered by a small committee of representatives of the Ministry of Agriculture, England, the Board of Agriculture for Scotland, and the Ministry of Agriculture for Northern Ireland, and co-ordinated with the results of the trials made at the testing stations of the two last-named Departments at Philipstoun and Kilkeel. During the early summer the weather conditions were unfavourable for the development of the wart disease, and it was therefore decided not to recommend for approval any of the first-early varieties which stood the tests in that year. A brief botanical description is given of the five new late or maincrop varieties approved in 1925 as immune from the disease, and of two varieties approved after the 1924 trials, but only recently placed on the market. These varieties are: Celurca, Dunaverney, Grannispud, The Mac, Main's Triumph, Response, and Wonderful.

SCHLUMBERGER [O.]. **Fünf Jahre Reichskrebsprüfungen.** [Five years' State trials for wart disease.]—*Deutsche Landw. Presse*, liii, 1, p. 1, 1926.

In connexion with the recent issue, by the Biologische Reichsanstalt (Berlin, Dahlem), of the annual leaflet on potato wart disease [*Synchytrium endobioticum*], a brief account is given of the methods and progress of the work of varietal selection in Germany. In 1921 the number of immune varieties known was 7; highly resistant 34; and susceptible 95. The corresponding figures for 1925 were 32, 26, and 153. Reference is made to the value of the investigations of Spieckermann and Kotthoff [see this *Review*, iv, p. 600], resulting in the facilitation of laboratory tests for varietal reaction to the fungus.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

VOL. V SEPTEMBER 1926

SCHLUMBERGER [O.]. **Die Produktion krebsfester anerkannter Pflanzkartoffeln in Deutschland im Jahre 1925.** [The production of wart-resistant, certified seed Potatoes in Germany in the year 1925.]—*Deutsche Landw. Presse*, liii, 10, pp. 113–114, 1926.

A further extension of the area devoted to the production in Germany of seed potatoes immune from wart disease [*Synchytrium endobioticum*: see this *Review*, iii, p. 600; iv, p. 697; and v, p. 512] has been recorded, namely, from 15,224 hect. in 1924 to 17,718 hect. in 1925. With an average yield of certified seed potatoes of 400 cwt. per hect., the available quantity in 1925 is estimated at 7,087,374 cwt. compared with 6,089,914 cwt. in 1924. The popularity of Thiele's Kuckuck has been maintained and Modrow's Direktor Johanssen is steadily gaining recognition. The largest quantities of certified seed in 1925 were produced by von Kameke's Parnassia, Modrow's Preussen, von Kameke's Pepo, and Richter's Jubel, in the order named.

DE BRUYN (HELENA L. G.). **The overwintering of Phytophthora infestans (Mont.) de By.**—*Phytopath.*, xvi, 2, pp. 121–140, 3 figs., 1926.

In continuation of her previous investigations on the saprophytic existence of *Phytophthora infestans* [see this *Review*, i, p. 399], the author conducted a further series of experiments in which the fungus, growing on various media at different stages of development, was exposed to a temperature range of − 9° to − 26° C. for periods of varying duration.

The oospores and resting forms (the term applied to all bodies which resemble oogonia or oospores in having a thick wall, but differ from the normal sexual spores in various particulars) were found to be capable of enduring a temperature of − 20° to − 26° for five days under dry conditions. The fungus grows best on old,

partially decayed plants, parts of which are present in most soils. Abundant moisture is necessary for the profuse development of *P. infestans*, but the capacity of the organism to withstand cold and desiccation (especially in manure, bog soil, and leaf mould) is probably sufficient to ensure its hibernation in the field. Should favourable conditions for this purpose exist in only a fraction of the field, an epidemic may occur in the following spring.

Under De Bary's assumption that infection by *P. infestans* arises exclusively in the tuber, a careful inspection of seed potatoes might be expected to prevent an epidemic of blight, especially in a year following a dry summer. The discovery of the occurrence of hibernation in the field, however, greatly invalidates the utility of this method of control, without suggesting any substitute, since the destruction of the fungus in the soil is at present impracticable.

SIMPSON (D.). **Sprays against blight in Potatoes and Tomatoes.** —*States' Exper. Farm, Jersey, Leaflet*, 4 pp., 1926.

Brief directions are given for the preparation and application of the following sprays for the control of late blight of potatoes and tomatoes [*Phytophthora infestans*] under Jersey (Channel Islands) conditions. (1) Bordeaux mixture, consisting of 10 lb. copper sulphate and 5 lb. fresh lime per 100 galls. water (or smaller quantities *pro rata*). (2) Burgundy mixture: 10 lb. copper sulphate and $1\frac{1}{2}$ lb. washing soda per 100 galls. (3) Caustic soda mixture: 10 lb. copper sulphate and $3\frac{1}{2}$ lb. caustic soda per 100 galls. The quantity of spray required is 1 to 2 galls. per Jersey perch. Nos. (1) and (3) are stated to be the most effective preparations. The efficacy of one application lasts for 10 to 14 days unless rain falls. The sterilization of tomato canes after harvest with formaldehyde (1 gall. in 20 galls. water) for the destruction of blight and sleepy disease [*Verticillium albo-atrum*] spores is recommended.

BRAUN (H.). **Ueber den Wert der Kartoffelbeizung, insbesondere über die Möglichkeit der Hypochnusbekämpfung mit Hilfe der Beizung.** [On the value of Potato disinfection, with special reference to the possibility of *Hypochnus* control with the aid of steeping.]—*Fortschr. der Landwirtsch.* [Vienna], 1, 6, pp. 201–206, 1926.

After reviewing the principal contemporary literature on the possibilities of controlling the *Hypochnus* disease of potatoes [*Corticium solani*] by seed disinfection, the writer's experiments on the lines of Gassner's chemotherapeutical investigations on cereal fungicides [see this *Review*, ii, pp. 554–557; iv, p. 231] are briefly described. The concentrations necessary for the destruction of the hyphae were surprisingly low, namely, for formaldehyde (two hours' immersion), 0·1 per cent.; uspulun and germisan, 0·025 per cent.; segetan, 0·00625 per cent.; and corrosive sublimate, 0·0025 per cent. The sclerotia, on the other hand, were very resistant, the *dosis curativa* being as follows: formaldehyde, 0·66 per cent.; uspulun and germisan, 2 per cent.; segetan, 0·25 per cent.; and corrosive sublimate, 0·2 per cent. The *dosis toxica* for formaldehyde was 0·66 per cent.; uspulun, 2 per cent.; germisan, 1 per cent.; segetan, 0·2 per cent.; and corrosive sublimate, 0·1 per cent.

The chemotherapeutical index was found to be as follows: formaldehyde and uspulun, 1; germisan, 2; segetan, 1·25; and corrosive sublimate, 2. Taking the upper limit for the index as 0·5 it would appear that none of the disinfectants used in these tests is entirely satisfactory.

McKay (M. B.). **Further studies of Potato wilt caused by Verticillium albo-atrum.**—*Journ. Agric. Res.*, xxxii, 5, pp. 437–470, 7 pl., 3 diags., 2 graphs, 1926.

Continuing his studies on the potato wilt caused by *Verticillium albo-atrum* [see this *Review*, i, p. 83], the author presents further evidence which confirms the conclusion that the presence or absence of this fungus cannot be reliably determined from a mere inspection of the tubers. Little reliance can be placed on tuber discoloration as a sign of wilt attack, nor upon the practice of discarding the discoloured stem end portions of infected tubers and planting the eye ends as a means of control. Spread from one plant to another takes place through contact of the root systems during the growing season.

Frequently, wilt-diseased plants (probably late infections) show no external symptoms, and consequently effective control by roguing can only be carried out by removing not only the visibly diseased individuals, but also the next adjoining apparently healthy plants on either side. This 'three-plant method' has resulted in reducing wilt from slightly more than 22 per cent. in the growing crop to 3·2 per cent. infection in the tubers within a single season, whereas where roguing was limited to the visibly diseased plants, the quantity of infected tubers was 8·4 per cent.

Infection by *V. albo-atrum* takes place through the roots and not through the seed piece when produced by artificial contamination of the soil, which is not the case in the wilt caused by *Fusarium oxysporum*. Infection occurred freely when inoculum was placed at a depth of nine inches below the seed piece and also 30 to 45 inches horizontally from the seed piece.

Viability tests have shown that the fungus survives very readily in old potato tops in the soil through a single winter but not through two seasons. Field tests showed that rotation with non-susceptible crops for three or four years can be considered a completely effective method of eliminating the fungus from the soil.

None of the twelve potato varieties tested shows any noticeable resistance to *Verticillium* wilt.

Morris (H. E.). **Field wilt (Fusarium) of Potatoes.**—*Montana Agric. Exper. Stat. Bull.* 184, 14 pp., 2 figs., 1926.

Fusarium wilt of potatoes (*F. oxysporum* or *F. oxysporum* var. *asclerotium*) [see this *Review*, iii, p. 63] is stated to be universally present in Montana, where it causes losses ranging from a trace to 15 per cent. of the crop. The symptoms do not become noticeable until the plants are about 1 ft. high, when the lower leaves lose their lustre, droop, and finally die, sometimes before the tubers reach a marketable size. The brown discoloration of the vascular ring (which has suggested the terms 'internal browning' and 'net necrosis') is very conspicuous in well-defined cases. Vascular

discoloration, however, has been found by the writer and others to be by no means a reliable indication of the disease, against which the use of selected seed and three to six years' crop rotation is recommended.

MORRIS (H. E.). **Storage dry rot of Potatoes.**—*Montana Agric. Exper. Stat. Bull.* 183, 10 pp., 2 figs., 1926.

Dry rot of stored potatoes, caused by *Fusarium trichothecioides*, *F. discolor* var. *sulphureum*, *F. subpallidum* var. *roseum*, and *F. clavatum* [see this *Review*, iii, p. 63], is stated to be generally distributed in the United States, and to be responsible for an average annual loss of 4 to 5 per cent. of the stock. The most susceptible varieties, under Montana conditions, have been found to be Early Acme, Blue Victor, Early Breakfast, Early Ohio, Improved Early Rose, and Green Mountain. The disease imparts a wrinkled, sunken appearance to the surface of the tubers, the infected tissue assuming a light brown to black tinge. Under moist conditions and at temperatures near 77° F. the first symptoms usually appear in about four days, and the tubers may be destroyed in three to five weeks. Good control can be ensured by storing the potatoes in a dry, well-ventilated place at 35° to 40°. Cellars or storehouses in which rot has occurred should be sprayed with copper sulphate or formalin solution (1 lb. per 10 galls. water) or fumigated with formaldehyde gas, before use.

MOORE (H. C.). **Hollow heart of Potatoes.**—*Quart. Bull. Michigan Agric. Exper. Stat.*, viii, 3, pp. 114–118, 1926.

In 1924 and 1925 many cars of potatoes from Michigan and other northern States are stated to have been rejected on account of hollow heart [see this *Review*, iii, p. 476], which is characterized by a lens-shaped cavity, surrounded by brown, discoloured flesh, at the centre of the affected tuber. According to the standards of the United States No. 1 grade of potatoes, not more than 6 per cent. by weight of tubers suffering from this condition is permitted.

This disturbance is believed to be associated with conditions favouring excessively rapid tuber development. Thus the heavy rainfall in August, 1924, is believed to have been an important factor in the prevalence of hollow heart, while inspection reports of certified seed potatoes in the autumn of 1925 showed practically no trace of this disease in the north-west of the Lower Peninsula, where dry conditions prevailed during late July and throughout August.

The results of artificial irrigation experiments [which are briefly described and presented in tabular form] gave further evidence of the importance of moisture in the etiology of hollow heart. Close spacing (36 by 18 inches) reduced the incidence of this disease and increased the yield.

Varieties of the Rural type, e.g., Rural New Yorker No. 2, Carman No. 3, Russet Rural, &c., together with Irish Cobbler, Early Ohio, and Spaulding Rose, have been found the most severely affected by hollow heart.

Among the cultural methods recommended for the control of this disease are rotation of the potato crop with legumes; application

of organic manure several months before planting; use of certified seed; and early planting to ensure maturity before the first frost.

YOUNG (V. H.). **Observations on the stem rot of Rice caused by Sclerotium oryzae Catt.**—Abs. in *Phytopath.*, xvi, 1, p. 86, 1926.

Stem rot caused by *Sclerotium oryzae* is stated to be the most serious disease of rice in Arkansas, all commercial varieties being attacked over a wide area. The incidence of the disease may be decreased by allowing infected fields to lie fallow for one season. The fungus also attacks red rice, a weed variety, which produces seed on unirrigated land, thereby tiding the organism over the fallow period. As a rule diseased plants do not occur in numbers until after the final drainage, but infected red rice has been found a month before harvest, and the heaviest losses occur in fields containing such self-sown plants. Seedling infections were secured with pure cultures *in vitro*, though not observed in the open. The date and amount of infection were not influenced by high soil temperatures (22·5° to 35° C.). Soil from infected fields gave positive results in the greenhouse. Growth of *S. oryzae* on rice stubble after harvest results in a considerable increase in the amount of overwintering material.

GADD (C. H.). **Hevea mildew.**—*Year-Book Dept. of Agric., Ceylon, 1926*, pp. 22–23, 1926.

A brief description is given of the morphology of the *Oidium* associated with abnormal leaf fall of *Hevea* rubber in Ceylon [see this *Review*, iv, p. 633], together with a short account of the symptoms of the disease, which would appear to be identical with that reported from Java [where the organism has been named *O. heveae*: see this *Review*, iv, p. 702].

The hyaline, septate conidiophores of the fungus, which measure up to 46 by 6 to 8 μ, abstrict short chains of not more than three hyaline, barrel-shaped, thin-walled conidia, constricted near the ends and measuring 30 to 33 by 12 to 16 μ.

It is thought possible that the fungus from one or more of the 31 plants on which species of *Oidium* are already known to occur in Ceylon has adapted itself to *Hevea* as a new host.

GADD (C. H.) & BERTUS (L. S.). **A Rhizoctonia disease of Vigna.**—*Year-Book Dept. of Agric., Ceylon, 1926*, pp. 31–33, 2 pl., 1926.

The symptoms of the *Rhizoctonia* disease of *Vigna oligosperma*, believed to be identical with that occurring in Java [see this *Review*, iv, p. 564], are described. Under Ceylon conditions the fungus seldom produces spores on *Vigna*, but the perfect stage has been found on groundnuts (*Arachis hypogaea*) and identified as *R. solani*. The crop is rarely destroyed outright in Ceylon, but the soil becomes badly infected with sclerotia and diseased leaves.

The results of laboratory inoculation experiments showed that the fungus readily produces the symptoms of damping-off in seedlings of the following species: cotton, French beans [*Phaseolus vulgaris*], *Dolichos lablab*, *Gliricidia maculata*, *Albizzia moluccana*,

Sesbania aculeata, *Crotalaria verrucosa*, *Tephrosia hookeriana*, Hubam clover (*Melilotus alba* var. *annua*), *Indigofera sumatrana*, Lima beans (*P. lunatus*), *V. oligosperma*, and cow-pea (*V. catjang*). On *Calapogonium mucunoides*, *Tephrosia candida*, *Indigofera arrecta*, *Centrosema pubescens*, *Clitoria cajanifolia*, *Cassia hirsuta*, *Crotalaria incana*, groundnut, and tobacco, the fungus causes a decay of the leaves and stem. On more woody plants the stems are 'ringed' by the attack and a swollen callus develops above the lesion.

The control of the disease (which at the time of writing had just been found also on rice) is likely to prove difficult. *V. oligosperma* should be removed from infected areas and replaced by other cover crops (*Indigofera endecaphylla* has shown signs of resistance) propagated from cuttings.

KINNEY (A.). **Cane diseases in the Hawaiian Islands.**—*Planter and Sugar Manufacturer*, lxxvi, 10, pp. 191–192, 1926.

A brief account is given of each of the following diseases of sugar-cane occurring in the Hawaiian Islands: eye spot [*Helminthosporium sacchari*: see this *Review*, v, p. 387]; mosaic, which is estimated to have caused a loss of only 0·6 per cent. of the crop of 775,000 tons in 1925; chlorosis; Pahala blight [see this *Review*, v, p. 326] in which dusting with manganous sulphate has led to the disappearance of the characteristic long yellow stripes on the foliage; and Lahaina disease [see this *Review*, v, p. 327], which is a result of growth failure attributed to a number of factors.

A[SHBY] (S. F.). **Gumming disease of Sugar-cane in the British West Indies.**—*Trop. Agriculture*, iii, 3, pp. 50–51, 1926.

Towards the end of 1925 gumming disease of sugar-cane was observed in St. Kitts on the H 109 (originally from Hawaii), Ba 11569 (from Barbados), and Transparent varieties, as well as on a so-called 'African' (probably Bourbon) cane introduced from Sierra Leone in 1918. It is stated to be unlikely that the disease came with the varieties imported from Hawaii and Barbados (where it is not known to occur), and the outbreak is therefore probably traceable to the only known infected area in the West Indies, namely, Porto Rico [see this *Review*, v, p. 135].

The symptoms of the disease are briefly described. In St. Kitts the withering of the tips of striped leaves was very conspicuous after a month's dry weather. Leaf striping was very prevalent on the Ba 6032 variety, though no gumming or reddening of the vascular bundles was apparent in the stalks. Leaf symptoms are considered to be a more sensitive indicator of the disease than the yellow exudation from the cut stalks. Under St. Kitts conditions Ba 6032 is very tolerant and a prolific yielder. Neither striping nor gumming was observed on BH 10 (12), SC 12·4, D 116, or White Tanna. The presence of these symptoms on plant cane plots of Ba 11569, only introduced in 1924, strongly suggested transmission from Ba 6032 by some aerial agency. D 109 was much affected by striping, but showed no gumming and gave a good yield, indicating a high degree of tolerance. It is hoped that the

disease may be eliminated in about two years by the use of resistant varieties.

Two yellow bacteria were isolated from affected material in St. Kitts, one of which behaves like *Bacterium vascularum* in culture.

In St. Lucia, where the disease was also observed, the affected canes were growing on heavy, low-lying soil. The desiccation of the leaf ends was less marked, but there was a greater tendency to striping of the inner leaves. Gumming was not detected in the stalks.

CIFERRI (R.) & GONZÁLEZ FRAGOSO (R.). **Hongos parásitos y saprofitos de la República Dominicana. (4ª Serie).** [Parasitic and saprophytic fungi of the Dominican Republic. 4th Series.]—*Bol. R. Soc. Esp. Hist. Nat.*, xxvi, 3, pp. 192–202, 6 figs., 1926.

Amongst the records of interest in this number of the series on parasitic and saprophytic fungi of the Dominican Republic [see this *Review*, v, p. 189], the following may be mentioned: *Corticium koleroga* on branches of coffee; *Phytophthora faberi* on fruits of cacao; *Thielaviopsis paradoxa* on fruits of pineapple: *Cercospora punicae* on leaves of cultivated pomegranate; *C. apii* on leaves of celery; *Cercosporella dominicana* sp. nov., characterized by elongated, pyriform or clavate, hyaline conidia, 35 to 50 by 2 to 3·5 μ, generally 4- to 5-septate, forming round, dry, reddish-brown, marginate spots, 1·5 to 3·5 mm. in diameter, on living leaves of *Portulaca oleracea*; and *Melanconium sacchari*, *Colletotrichum falcatum*, and *Sclerotium rolfsii* on sugar-cane.

IVANOFF (B.). **Нищи растителни паразити върху културнитѣ ни растения, появили се въ продолжение на последнитѣ петь години (1921–1925).** [Cryptogamic parasites of cultivated plants recorded in the course of the last five years (1921–1925).]—*Сведения по Земледѣлието Период. Бюл.* [*Agric. Inform. Period. Bull.*], *Sofia*, vii, 3, pp. 14–17, 1926. [German summary.]

In this list brief descriptions are given of 26 species of parasitic fungi and bacteria (seven of which are stated to be new records for Bulgaria) which were not included in the previous lists published by the author [see this *Review*, iv, p. 418]. The following are of interest.

Bacillus sesami Malk. was found in two localities attacking the leaves and stems of sesame [*Sesamum indicum*]; a thick, gummy, rapidly drying substance exuded from the surface of the black spots formed by the organism, the stems usually breaking down at the point attacked. *Tilletia levis* was recorded in one district on rye. *Fusarium vasinfectum* was found on lupins and on French beans; the fungus is stated to overwinter in rotting plants that remain in the field. *Gloeosporium phomoides* on tomato fruits caused the appearance, towards maturity, of black dots, the size of a pin-head; infection generally occurs through wounds. *Phyllosticta phaseolina* was recorded in the experimental field of the Plant Protection Station in Sofia on the leaves of French beans, on which it formed ochre-yellow spots. *Phyllosticta malkoffii* was

found on the leaves of cotton in one locality. *Sphaerella mori* caused severe injury in Svilengrad to the leaves of black mulberry [*Morus nigra*], on which it formed rounded, dark brown spots with reddish-brown margins.

NAOUMOFF (N. A.). О нескольких новых или малоизвестных видах. [Some new or little-known species.]—*Morbi Plantarum*, Leningrad, xiv, 4, pp. 137–149, 1 pl., 1 fig., 1926.

Descriptions, with Latin diagnoses, of two new genera and ten new species of parasitic fungi from the governments of Leningrad and Novgorod are given, of which the following are of interest.

Ascocalyx abietis n. gen., n. sp., on dying branches of *Abies sibirica*, in association with *Pycnocalyx abietis* Naoum., of which it was shown to be the ascophorous stage. The author places this fungus among the Dermataceae close to *Tympanis*, from which it differs by the absence of an epithecium and the regularly eight-spored asci. *Phoma dothideicola*, parasitizing the stroma of *Dothidea ribesia* on red currants. *Dothichiza piceana*, on branches of *Picea excelsa*. *Ascochyta solani-tuberosi*, on living stems of the potato, on which it forms large, diffuse, discoloured spots, frequently extending over several centimetres in length and often girdling the stem or even, in advanced stages, covering the whole of the latter. Such discoloured areas are thickly dotted with dark brown, sub-epidermal pycnidia, 80 to 160 by 50 to 130 μ. The pycnidia arise in a radiating, articulate, dark brown mycelium under the epidermal cells. The spores are hyaline, ellipsoidal or cylindrical, very variable in size (from 3 to 4 by 2 μ up to 7 to 12 by 3 μ), usually one-septate, but the smaller spores generally continuous. In its pathogenic and morphological characters this species is stated to resemble *Phoma solanicola* Prill. et Delacr., except for the presence of a septum in its spores, but the author was unable to compare the two organisms.

LAUBERT (R.). **Ein Beitrag zur Schmarotzerpilzflora von Sassnitz.** [A contribution to the parasitic fungus flora of Sassnitz.]—*Hedwigia*, lxvi, 2, pp. 93–102, 1926.

During a visit to Sassnitz [Pomerania] in September, 1925, the writer collected and determined a number of parasitic (mostly leaf-inhabiting) fungi, which are here listed according to hosts. A new species of *Cylindrosporium* found on the pods of *Lathyrus silvestris* is described but not specifically named, since it is doubtful if it is distinct from that described under the name *Septoria silvestris* by Passerini though certainly belonging to the former genus.

DUFRÉNOY (J.). **La vie parasitaire et la vie saprophytique des Phytophthorées.** [The parasitic and saprophytic life of the Phytophthorae.]—*Rev. Gén. des Sciences*, xxxvii, 5, pp. 146–149, 1926.

The principal current literature on the Phytophthorae, which the author regards as a natural group, including *Pythium*, *Pythiacystis*, *Phytophthora*, and *Blepharospora*, is reviewed and discussed, with special reference to their systematic position [see also this *Review*, v, p. 4], and the work of earlier investigators is also re-

called. The paper comprises the following sections: (1) parasitism; (2) possibility of existence outside the host; (3) life in the soil; (4) aquatic existence; (5) parasitic existence; and (6) problem of specificity. In conclusion the writer emphasizes the need, both from a scientific and economic standpoint, for a rational classification of the Phytophthorae.

QUINTANILHA (A.). **Contribuição ao estudo dos Synchytrium.** [Contribution to the study of the genus *Synchytrium*.]—Reprinted from *Bol. Soc. Broteriana*, Ser. II, iii, 110 pp., 4 pl., 1 fig., 1926.

This comprehensive monograph on the genus *Synchytrium* comprises an account of the evolutionary cycle of the morphological type of the genus; a history of investigations on *Synchytrium* since its foundation in 1863 by De Bary and Woronin; a detailed study of *S. papillatum*, first described by Farlow in 1885 as a parasite of *Erodium cicutarium* in California, and recently found by the writer on a new host, *E. moschatum*, in Portugal, the two forms being considered, pending further observations and experiments, to be identical; a classification of the genus, which the writer subdivides into *Eusynchytrium* (including *S. endobioticum* and *S. papillatum*) and *Pycnochytrium*, comprising 20 other species; and a discussion of its systematic position and affinities. A biblography of 80 titles is appended.

CUNNINGHAM (G. H.). **Third supplement to the Uredinaceae and Ustilaginaceae of New Zealand.**—*Trans. New Zealand Inst.*, lvi, pp. 74–80, 2 figs., 1926.

Further additions are made to the rusts and smuts included in the author's recent monographs of the existing New Zealand species [see this *Review*, iv, p. 248]. *Chrysomyxa rhododendri* is recorded on cultivated rhododendrons as an introduced species.

GADD (C. H.). **A note on branch canker of Tea.**—*Year-Book Dept. of Agric., Ceylon, 1926*, pp. 7–8, 1 pl., 1926.

In this paper the writer draws attention to the misleading impression created by the use of the term 'branch canker' for two totally distinct types of injury: one caused by the attacks of such organisms as *Macrophoma theicola*, and the other resulting from a wood rot, generally starting from the pruning cut and frequently accelerated by the invasion of termites. The term 'branch canker' should be restricted to the former type of injury, while the latter, which is described in detail, should be known as wood rot. This condition may be prevented by the application of an antiseptic covering, such as tar, to the pruning cuts. On low-country estates, where *Macrophoma* branch cankers are prevalent, it may be necessary to spray the bushes, after pruning, with Bordeaux mixture, but even in such cases the wounds require to be protected against rot by tarring.

GADD (C. H.) & RAGUNATHAN (C.). **A leaf disease of Tea caused by Macrophoma theicola Petch.**—*Year-Book Dept. of Agric., Ceylon, 1926*, pp. 16–18, 1 pl., 1926.

The occurrence of *Macrophoma theicola* on tea leaves in the

Ragalla district in 1924 is reported. The affected foliage showed large, chocolate-coloured or reddish-brown areas with definite, irregular margins, separated from the healthy portion by a narrow yellow zone. The apical part of the leaf was most generally affected. Inoculation experiments made with pure cultures of the fungus gave positive results on wounded leaves only. On wounded stems symptoms similar to those of the well-known branch cankers [see preceding abstract] were produced. A comparison of the tea leaf fungus with *M. theicola* from typical branch cankers, which also infected wounded leaves, led to the conclusion that the two strains are morphologically identical.

BERNARD (C.). **Kankergezwellen op den Theestam.** [Canker swellings on the Tea stem.]—*De Thee,* vi, 2, pp. 40–42, 2 pl.; 1925.

The occurrence of tumours, resembling those caused on various hosts by the crown gall organism (*Bacterium tumefaciens*), on the stems of tea plants in Java is briefly described. All the tissues of the stem are attacked, and the wood is abnormally thickened, hardened, and distorted. Secondary infection by *Ustulina maxima* [*U. zonata*], *Dermatea* sp., *Ganoderma ferreum* [see this *Review,* v, p. 54], and other fungi and bacteria has been observed on affected stems. On the roots small swellings may occur as the result of wounds. The stem tumours, which may attain a considerable size, have only been found sporadically, and appear to cause little damage. Infection has not been observed to spread to the neighbouring bushes. Further investigations are necessary before the disease can be definitely ascribed to *Bact. tumefaciens.*

PARK (M.). **A die-back disease of Dadap (Erythrina lithosperma).** —*Year-Book Dept. of Agric., Ceylon, 1926,* pp. 9–12, 2 pl., 1926.

The die-back of dadaps (*Erythrina lithosperma*) first reported from the Badulla district in 1924 [see this *Review,* v, p. 147] is described, and an account is given of the morphological and cultural characters of the species of *Fusarium* which was shown by inoculation experiments to be capable of causing the condition, especially on wounded stems and branches.

The hyphae of the fungus on agar cultures are slender, regular, septate, hyaline, 1 to 2 μ in diameter, branching freely, and sometimes showing anastomoses. The profuse mycelium is of a dirty white colour. Microconidia of variable shape, measuring on an average 7·2 by 3·1 μ, are formed on short, single conidiophores, while the generally 5-septate macroconidia, which measure 54·2 by 4·7 μ, are borne in honey-, amber-, or yellow-brown sporodochia, up to 3 by 1·5 mm. by 1 mm. high. Smooth, thick-walled, intercalary or terminal chlamydospores, 8 to 10 μ in diameter, may be formed singly or in chains of two to four on the mycelium or from the macroconidia.

The die-back of dadaps occurs in a serious form chiefly under unsuitable climatic conditions, excessive rainfall being an important factor in this connexion. The trees should be lopped in dry

weather, and the cut ends tarred as soon as the sap ceases to run. The abundant production of air-borne spores on dead tissue necessitates the immediate destruction of all infected material.

Eckerson (Sophia H.). **An organism of Tomato mosaic.**—*Bot. Gaz.*, lxxxi, 2, pp. 204–209, 4 pl. (1 col.), 1926.

A description is given of the organisms observed by the writer since 1922 in mosaic tomato and other plants.

Motile bodies were observed in all the mottled leaves of mosaic tomato plants, while very young individuals, before showing any trace of mottling, revealed hundreds of minute, rapidly moving organisms in the mesophyll cells, and the phloem cells contained elongated forms with a typically flagellate movement. Older leaves with pronounced mottling contained melon-shaped, spore-like forms with a hyaline membrane embedded in the few remaining chloroplasts and occurring free in the cells.

Of the many vital stains tested for the differentiation of these organisms, the combination of methylene blue and eosin was the most satisfactory for the small, and brilliant cresyl blue in combination with acid fuchsin for the large bodies. For the observation of the organisms in a fixed position iron haematoxylin and azure eosin proved useful.

Twenty-four hours after the inoculation of alternate leaflets of a series of young tomato plants with filtered juice from mosaic plants, minute flagellate organisms were observed in the veins and adjacent mesophyll cells of the leaflets opposite to the inoculated ones, while in a few of the cells near the veins the chloroplasts were beginning to show signs of dissolution, accompanied by the presence of small organisms.

The dissolution of the chloroplasts was progressive, and ten days after inoculation some of the leaflets were beginning to show mottling, accompanied by partial disorganization of the contents of the palisade cells. Twenty to thirty days after inoculation most of the cells had neither cytoplasm nor chloroplasts, and had become filled with melon-seed-shaped spores, which, when mature, have a highly refractive hyaline membrane of slight permeability and are difficult to stain. In the early stages many spore cases show a spiral filament still attached, while among the numerous detached tails on the slide are many minute flagellate forms.

Peculiar bodies, resembling Japanese lanterns in the living tissue, were detected in two of the inoculated series. When stained with iron haematoxylin they clearly showed two or three organisms, of the type present at the inception of the disease, within each.

Motile organisms were observed in wheat affected by rosette [see this *Review*, v, p. 86]. In the first few days of infection, numerous minute, flagellate forms (2 to 4 μ) were observed in the cells, while a week later larger motile forms (5 to 7 μ) predominated. In the later stages large, non-motile bodies were the chief occupants of the cells.

Minute organisms were found in the youngest leaves of inoculated plants of *Hippeastrum johnsoni*. Elongated, flagellate forms occurred in the phloem tissue of older leaves of *H. johnsoni*, *Dahlia*, and squash [*Cucurbita*]. Large, slow-moving bodies were found

in *H. johnsoni* and squash; while in severely mottled leaves of all these plants spore forms were detected.

PURDY (HELEN A.). **Attempt to cultivate an organism from Tomato mosaic.**—*Bot. Gaz.*, lxxxi, 2, pp. 210–217, 1926.

Using a method substantially identical with that of Olitsky [see this *Review*, iv, p. 300], the writer conducted a series of experiments [the results of which are presented in tabular form] in the cultivation of an organism from tomato mosaic.

Of the 50 plants inoculated from virus cultures containing original inoculum (obtained by grinding mosaic shoots, adding water, centrifuging, and filtering through paper pulp and Berkefeld 'W' filters) in an estimated dilution of approximately 2×10^{-3}, 41 developed mosaic. Sub-cultures from these cultures produced infection in 13 out of 70 plants receiving virus in a dilution amounting to 2×10^{-4} of the original virus. On reaching the dilution 2×10^{-5}, the virus cultures infected only six out of 70 plants, while a 2×10^{-6} dilution failed to produce mosaic in any of the inoculated plants.

Of the five separate virus cultures made in the tomato extract medium, three lost their power of infectivity at a dilution of the original 0·01 c.c. of virus approximating to 2×10^{-5} or 1 in 50,000, while the two others produced no mosaic at the next sub-plant, equivalent to 2×10^{-6} or 1 in 500,000.

In two water cultures tested, the power of infectivity was lost at a dilution of the original 0·01 c.c. of virus approximating to 2×10^{-5} or 1 in 50,000.

These results are briefly discussed with the conclusion that they give no indication of the multiplication, outside the living plants, of the active agent producing mosaic in tobacco and tomato [see also this *Review*, iv, p. 689; v, p. 441].

SIEMASZKO (W.). **Notatki fitopatologiczne, III. 1. Zgnilizna Pomidorów (Phytophthora infestans De By. f. sp. lycopersici). 2. Mączniak dębowy (Microsphaera alni (D. C.) Wint. var. quercina).** [Phytopathological notes, III. 1. Tomato rot (*Phytophthora infestans* De By. f. sp. *lycopersici*). 2. Oak mildew (*Microsphaera alni* (D. C.) Wint. var. *quercina*).]—*Choroby i Szkodniki Roślin* [*Diseases and Pests of Plants*], *Warsaw*, i, 4, pp. 43–51, 1925. [English summary. Received April, 1926.]

The tomato crop in the neighbourhood of Skierniewice [Poland] is stated to have suffered severely during the summers of 1924 and 1925 from a rot that attacked the still green fruit in the field. The first symptom was the appearance of large greyish spots which, as the fruit ripened, turned brown, and became somewhat sunken, but without breaking the cuticle. The rot penetrated deep into the fruit, usually involving the greater part of the core. In damp chambers the diseased fruit developed an abundant, whitish, aerial mycelium bearing conidiophores from 800 to 1,000 μ long, with cylindrical conidia, 15 to 47·8 by 12 to 26 μ (usually 28·6 to 36·8 by 17·7 to 20·3 μ). The shape of the conidiophores and the dimen-

sions of the conidia of this fungus lead the author to believe that it is a specialized form of *Phytophthora infestans*. Inoculation experiments of potato tubers with the tomato fungus, as well as inoculations of tomato fruits with a strain from potatoes, gave negative results. Differences in the resistance of tomato varieties to the disease were observed, the kinds having fruit with a thick cuticle being the more resistant.

The second part of these notes deals with the systematic position and the probable origin of the European form of the oak mildew (*Microsphaera alni* var. *quercina*) [*M. quercina*]. A comparison of the morphological characters [given in two tables] of the two American forms, *M. alni* var. *abbreviata* and *M. alni* var. *extensa*, collected by the author in North America, and of the European form, collected by him in various European countries, leads him to consider that the latter is more closely related to *extensa* than to *abbreviata*. Certain slight differences, however, do not allow its identification with the form *extensa* without further biological experiments. He also considers that there is but one species in Europe, and that the differences in the number of ascospores in the asci, length of appendages, and the like, that have been noted by various investigators, were due to variations in the maturity of the perithecia examined. In his opinion, the fungus is of European origin, and was not imported from America; the appearance of the perithecial stage is thought to be dependent on climatic conditions and not, as believed by some authors, the result of the completion of the developmental cycle of the organism.

Dimitroff (T.). Вредни за нашитѣ гори и горски култури гѫби. (Приносъ трети). [Fungi injurious to our forests and silviculture. (Third contribution.)]—*Bull. Soc. Bot. de Bulgarie*, i, pp. 53–66, 1926. [French summary.]

In view of the ever-increasing damage done by parasitic fungi, especially in newly reafforested areas, the author started a systematic survey of the forest fungi of Bulgaria in 1922, of which the present is the third list published. Brief descriptions are given of 38 species, 18 of which are stated to be new records for Bulgaria.

Phytophthora omnivora was found in 1925 attacking the roots and needles of *Pinus sylvestris* seedlings, on which it formed black spots. *Lophodermium pinastri* is very prevalent in some localities on the leaves of *P. sylvestris* and *P. leucodermis*, especially on marshy soil, where the author considers that any attempts to cultivate the former should be abandoned. *Lophodermium macrosporum* attained epidemic severity in a 15- to 18-year-old plantation of *Picea excelsa*, causing extensive defoliation. *Trichosphaeria parasitica* occurs on 15- to 80-year-old trees of *Abies pectinata*, on the needles of which it forms very small, round perithecia; the young shoots attacked have a stunted appearance. *Herpotrichia nigra* attacked *Pinus mughus*, forming a thick, greyish-black felting which agglutinated the needles to one another. *Nectria cinnabarina* was found on a dry branch of walnut (*Juglans regia*). *Venturia tremulae* formed blackish spots on the upper side of the leaves of *Populus tremula*, and *Rhytisma salicinum* on those of *Salix alba*. *Diplodia castaneae* caused canker-like swellings on

branches of *Castanea sativa*. The list also comprises eleven species of *Polyporus*.

GARD (M.). **Le pourridié du Noyer.—Traitements et mesures préventifs.** [The root rot of Walnut.—Treatments and preventive measures.]—*Rev. de Vitic.*, lxiv, 1654, pp. 188–191, 1926.

As a sequel to his previous paper [see this *Review*, iv, p. 577] describing the curative treatment of walnut root rot (*Armillaria mellea*), in the present note the author gives some advice as to practical measures tending to prevent or reduce the incidence of the disease. These consist in the usual sanitation, precautions against unnecessary wounding of the roots and collar of the trees, and the application of stable or artificial manures to promote vigorous growth. Particular attention is called to the advisability of wide planting, as the walnut is naturally a solitary tree and needs plenty of space and light.

GRAVES (A. H.). **Forest pathology.**—*Fifteenth Ann. Rept. Brooklyn Bot. Gard., 1925*, pp. 58–60, 1926.

The results of an examination of chestnut trees exhibiting partial resistance to bark disease (*Endothia parasitica*) [see this *Review*, v, p. 456] showed that the roots are much more resistant than the shoots to the attacks of the fungus. In roots and shoots of approximately the same diameter and from the same tree, inoculated with a pure culture of *E. parasitica*, the parasite made little growth in the root tissue, but girdled the shoots in all cases. Recent investigations have shown that in the samples analysed the tannin content of the roots was more than twice that of the trunk. It is this greater resistance of the roots which facilitates the development of basal shoots [loc. cit.] which occasionally bear nuts. This fact is regarded as of great significance in the future of the tree, its extinction being indefinitely postponed by the production of seeds. About 100 nuts obtained from such chestnut shoots near Portland, Maine, have been planted out in the hope of breeding resistant stock.

The paper birch (*Betula alba* var. *papyrifera*) has developed small cankers showing the typical perithecia of *Creonectria coccinea* [*Nectria coccinea* Fr.] as the result of inoculation with the fungus from yellow birch (*B. lutea*). This is the first record of the disease on a white-barked species. Infection occurs also on *B. lenta*, and probably on *B. populifolia*.

McC[ALLUM] (A. W.). **Forest pathology.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 4–5, 1925. [Received June, 1926.]

As in previous years, the white pines [*Pinus strobus*] in the part of Ontario bordering on the Ottawa river have remained free from blister rust [*Cronartium ribicola*], which has been found, since 1919 at least, on cultivated *Ribes* in the district. The reason for the apparent immunity of this very fine stand remains obscure.

By the end of 1923 currants were generally infected throughout the Dry Belt of British Columbia, in the area south of the main line of the Canadian Pacific Railway to the international boundary, and extending to Grand Forks in the east. In the interior Wet

Belt infection was prevalent from Notch Hill to beyond Revelstoke and south to Renata and Nelson. The conditions during 1924 were most unfavourable to the spread of the disease. Canoe, Revelstoke. and Beaton are still the only known centres of pine infection.

Red heart rot [*Stereum sanguinolentum*] and feather rot [*Poria subacida* in part: see this *Review*, iv, p. 713] were found to be the chief causes of decay of the balsam fir (*Abies balsamea*) in the Metis Lake area south of the St. Lawrence.

Güssow (H. T.). **Cultural studies of wood-destroying fungi.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 5–6, 1925. [Received June, 1926.]

Cultural studies were made during 1924 by Miss Irene Mounce of *Fomes pinicola* [see this *Review*, iv, p. 518], which has been reported to occur on 82 species of conifers and deciduous trees. The fungus causes a rapid and complete destruction of the wood, characterized by a dark discoloration, due to the removal of cellulose, and by the appearance of numerous horizontal and longitudinal cracks produced by shrinkage. Gradually these spaces become filled with masses of white mycelium, and in the final stages the wood is reduced to a friable mass united by mycelial felts. Badly decayed wood gives characteristic lignin reactions. Sterilized wood blocks inoculated with fragments of *F. pinicola* cultures developed an altogether similar rot.

Sporophores of *F. pinicola* were obtained on various media and on the wood of eleven different coniferous and deciduous trees. The monosporous mycelia of *F. pinicola* having so far either proved sterile or produced only atypical fruiting bodies, the conclusion has been reached that the fungus is heterothallic.

Humphrey (C. J.). **Nature and cause of decay in building timbers.**—*Proc. Eleventh Ann. Meeting of Building Officials' Conference, Madison, 1925*, pp. 133–151, 19 figs., 1925. [Received May, 1926.]

The author discusses in popular language the wood-destroying fungi associated in the United States with the decay of building timbers, and the influence of moisture and temperature on them. So far as is known, these fungi will not attack wood to any appreciable extent when the moisture content is below the fibre-saturation point, which varies from 20 to 30 per cent. of the oven-dry weight of the wood, according to the species of timber. A table is given showing the wide variation in the moisture content of different 'green' timbers used for structural purposes. It has been proved, however, that initial dryness of timber does not necessarily ensure immunity from attack if the surroundings are themselves damp and badly ventilated. Under moist conditions it is essential to ensure proper ventilation and the prevention of condensation of moisture on the timber, which should never come in contact with the soil unless treated with preservatives, and should not be laid directly on concrete or bricks. Covering, oiling, or painting timber before it is thoroughly dry will lead to decay.

Numerous illustrations are given of cases of decay in building timbers observed by the writer, with a discussion of the factors

responsible. It is stated that the trouble is much worse in the southern States than in the drier and cooler parts of the country.

The practical advantage of treating timber with preservatives is emphasized, and a short description is given of the four standard methods of application, by pressure, hot and cold baths, steeping, and dipping in creosote, respectively, used in the United States, the efficiency of which is stated to be in the order given.

HUMPHREY (C. J.) & MILES (L. E.). **Dry-rot in buildings and stored construction materials and how to combat it.**—*Alabama Polytechnic Institute, Exten. Circ.* 78, 24 pp., 3 pl. (1 col.), 13 figs., 1925. [Received May, 1926.]

This paper records the results of investigations made by the authors during 1923 on the dry rot of timber in Alabama, where it is caused chiefly by *Poria incrassata* [see this *Review*, iv, p. 646]. The trouble is stated to be on the increase, and to have caused serious damage to many buildings. The cases so far reported are said to represent losses to property of some $200,000 in fifteen towns alone.

The different stages in the growth of the fungus are described, and an illustrated account is given of the various types of injury caused by it. The attack may be due to conditions arising during the lumbering and storing of the timber or during or after the construction of the building. The factors inducing dry rot caused by this fungus are discussed in detail [see last abstract] and control measures are indicated.

MATSUMOTO (T.). **On the relationship between Melampsora on Salix pierotii Miq. and Caeoma on Chelidonium majus L. and Corydalis inscissa Pers.**—*Bot. Mag.* (*Tokyo*), xl, 470, pp. 43–47, 2 figs., 1926.

The results [presented in tabular form] of cross-inoculation experiments with the *Caeoma* from *Chelidonium majus* and *Corydalis inscissa* and the *Melampsora* from *Salix pierotii* showed that the two forms are genetically connected. This *Melampsora* may not be identical with the species on *S. babylonica*, since inoculations on the latter failed. The chief differences between the present species and the closely related *M. magnusiana* on *Populus* spp. are briefly summarized, the former being diagnosed as a new species, *M. chelidonii-pierotii*, with roundish to oval, finely and densely echinulate aecidiospores, measuring 13 to 19 by 12 to 15 μ; oval to elongated uredospores, 16 to 23 by 13 to 16 μ, accompanied by capitate paraphyses measuring 18 to 22 by 20 to 25 μ; and cylindrical or cuneiform teleutospores, 20 to 64 by 6 to 8 μ.

NAOUMOFF (N. A.). Материалы по изучению Капустной килы. [Contribution to the study of club-root of Cabbage.]—*Morbi Plantarum*, Leningrad, xiv, 2–3, 24 pp., 1925. [Received June, 1926.]

The author describes experiments made in 1924 and 1925, partly on plants grown in pots, with a view to establishing the different factors affecting the infection of the host by *Plasmodiophora brassicae*, and the nature of the resistance of Cruciferae to the organism.

The experiments showed conclusively that infection of cabbages can occur at any age from the seedling stage to the second year of growth. The indications are, however, that infection of the seedlings does not take place until they are three to four weeks old. The location of the swellings on the roots invariably coincided with the level in the sterilized soil at which the inoculum was placed. This tends to show that the organism does not advance in the soil in a vertical direction, and also that infection can occur at any point of the cortex and not necessarily through root hairs. Infection was found to be dependent on the number of spores present in the soil, there existing a certain comparatively high minimum under which the plants are not infected. The seeds of cabbage were shown not to be carriers of the disease.

Spores of the organism kept over winter in a cellar under relatively dry conditions caused infection of seedlings the next year, but a year later they were no longer viable. When kept over winter in a room, they lost their infective power within a year, probably owing to desiccation. A resting period is not essential for germination, as infection was obtained with freshly collected spores from recent swellings. In preliminary tests, exposure for 10 or 15 minutes to temperatures ranging from 60° to 84° C. killed the spores.

To test the effect of the hydrogen-ion concentration of the soil solution on the incidence and development of club-root, three series of experiments were made, in two of which seedlings of a very susceptible variety of cabbage were grown in pots, in soil known to be infected, the P_H value of the soil solution being adjusted to range from 6·0 to 7·5 by watering with weak acid or alkali solutions. Infection and development of the disease appeared to occur most readily at P_H 6·0 to 6·5. In the third series seedlings raised in the usual way from sterilized seed were placed in buffer solutions [the composition of which is given] which were adjusted to range from P_H 9·2 to 5·3. All attempts at infection in this series gave negative results on account of the failure of the spores to germinate, although it was noted that spores kept for a week in acid solutions at P_H 6·0 were still able to infect seedlings grown in sterilized soil. Spores placed for the same time in alkaline solutions, however, were found to have lost their infective power.

In a table are given the results of infection experiments on 180 species belonging to 49 genera of Cruciferae, in which it is claimed that the susceptibility of plants belonging to the sub-family Thelypodieae has been established for the first time. The hosts of *Plasmodiophora brassicae* determined by Halsted, Cunningham, and Appel and Werth are also listed.

PAPE (H.). **Eine wenig bekannte Form der Herniekrankheit bei Kohlrüben mit einer Bemerkung über die Sporengrösse von Plasmodiophora brassicae Wor.** [An unfamiliar type of club-root disease in Swedes with an observation on the spore dimensions of *Plasmodiophora brassicae* Wor.]—*Pflanzenbau*, ii, pp. 172–173, 2 figs., 1925. [Abs. in *Bot. Centralbl.*, N.F., vii, 11–13, p. 404, 1926.]

Diseased swedes examined by the writer showed none of the finger-shaped excrescences and protuberances generally associated

with attacks of club-root (*Plasmodiophora brassicae*), but instead exhibited lesions, the tissues of which were filled with the grey spore masses of the fungus. The explanation offered is that the original excrescences decayed as a result of excessive humidity of the soil, leaving the lesions in their place.

In plants of six different origins examined by the writer the spores measured 2·6 to 3·4 μ, as against 1·6 μ according to Woronin.

NICOLAISEN. **Beizversuche zu Erbsen, Rosenkohl und Gurken.** [Disinfection experiments with Peas, Brussels Sprouts, and Cucumbers.]—*Nachr. über Schädlingsbekämpf.* (formerly *Nachrichtenbl. Landw. Abteil. Farbenfabriken vorm. F. Bayer & Co., Leverkusen bei Köln-am-Rhein*), i, 1, pp. 12–13, 2 figs., 1926.

The development of leaf spot and wilt ('St. Johanniskrankheit') of peas (*Ascochyta pisi* and *Fusarium vasinfectum*) was prevented, in the writer's experiments, by immersion in a 0·25 per cent. solution of uspulun, which also stimulated the germination and growth both of peas and Brussels sprouts. Agfa [Wolfener Farbenfabrik, Kr. Bitterfeld] proved to be a reliable disinfectant and stimulant for cucumber seeds.

Afsvampning af Runkelroefrø og Sukkerroefrø. [Disinfection of Beet and Sugar Beet seed.]—*Statens Forsøgsvirksomhed i Plantekultur Medd.* 121, 3 pp., 1926.

In six of the years 1906 to 1925 root rot of beets (associated with *Phoma betae, Pythium de Baryanum,* and other fungi) occurred in a severe form over a large part of Denmark.

Preliminary experiments in the control of the disease by disinfection of the seed-clusters have been conducted for a number of years, and in 1924 and 1925 a series of yield experiments was instituted at Lyngby and elsewhere. The best results were given by two hours' immersion in a 0·25 per cent. solution of germisan; one hour in a 0·2 per cent. solution of tillantin C; and dusting with tillantin C at the rate of 7·5 to 10 gm. per kg. of seed. Other useful preparations included germisan 225, 1762 B (Meyer, Mainz), agfa dust, and uspulun. Only in one case of marked deficiency of lime was there any significant increase of yield from seed disinfection.

Brief directions are given for the application of both the liquid and dry methods of disinfection. [This paper appeared also in *Ugeskrift for Landmaend*, lxxi, 8, pp. 120–121, 1926.]

GHESQUIÈRE (J.) & HENRARD (J.). **Sphaeriacée nouvelle des feuilles du Manioc au Congo belge.** [New Sphaeriaceae on the leaves of Cassava in the Belgian Congo.]—Reprinted from *Rev. Zool. Afr.*, xii, 4, *Suppl. Bot.*, 2 pp., 1 fig., 1924. [Received June, 1926.]

Brief French and Latin diagnoses are given of a leaf spotting organism occurring, in association with *Septogloeum manihotis* [*Cercospora cassavae*: see this *Review*, v, p. 144], on neglected cassava (*Manihot utilissima*) plants at Mayomba, on the Equator, and also near Stanleyville (Belgian Congo). The black, spherical (later protuberant) perithecia, measuring 90 to 110 μ at maturity,

are scattered over the upper surface of the desiccated spots with brown margins, which are about 1 cm. in diameter. The clavate, elongated, irregular asci, measuring 60 to 70 μ in length, contain eight ovoid, hyaline, bilocular ascospores, 21 by 6·6 μ, the two unequal cells of which each contain two oil drops. The fungus has been named *Mycosphaerella* (*Sphaerella*) *manihotis* Ghesq. et Henr.

BLIZZARD (A. W.). **The nuclear phenomena and life history of Urocystis cepulae.**—*Bull. Torrey Bot. Club*, liii, 3, pp. 77–117, 4 pl., 1926.

Onion seedlings are infected by the smut fungus (*Urocystis cepulae*) as they make their way through the soil. Infection occurs only through the cotyledons, on which mature pustules appear within three to four weeks.

Mature spores from unopened sori were germinated in onion decoction or on onion agar. Germination begins in three to seven days by the protrusion of a hemispherical promycelium which buds out eight or less hyphae; these in their turn produce a mycelial weft which becomes discernible in about ten days.

The fungus was isolated and cultured on onion agar, and on sterile potato, onion, bean, and carrot. During germination the fusion nucleus divides within the spore, the nuclei migrating through the short promycelium to the promycelial branches, which ultimately segment into uninucleate cells. The saprophytic mycelium is uninucleate throughout its existence. Each mycelial cell of the saprophytic mycelium may function as an oidial spore, serving to propagate and disseminate the fungus in the soil. These oidial spores are uninucleate and on germination produce uninucleate mycelium, as also do the resting spores. Both the saprophytic mycelium and the fungus in the soil were shown by experiments to be resistant to protracted desiccation.

Under experimental conditions, and probably also in the field, seedling infection takes place directly from the saprophytic mycelium, producing an intercellular parasitic mycelium. The cells of the latter, at first uninucleate, become progressively binucleate as they approach the young sorus primordium.

The fertile spore is produced by a binucleate, centrally located cell of a sporogenous branch. The two nuclei in the young spore soon fuse and the cell then grows rapidly, the pseudospores, which also originate in the binucleate cells of the sporogenous branches and serve as 'nurse' cells to the central spore, becoming appressed upon its surface.

MCGINTY (R. A.) & THOMPSON (R. C.). **Preliminary notes on tipburn of Lettuce.**—*Proc. Amer. Soc. Hort. Sci. 1925*, pp. 341–346, 1926.

Tipburn of lettuce [see this *Review*, v, p. 274], which is stated to be of considerable importance in Colorado, is generally believed to to be due to a high rate of transpiration, which removes the water from the leaf margin more rapidly than it can be replaced, thus causing desiccation of the tissues at that point.

In the greenhouse plants of the New York variety used in the

writers' experiments on the etiology of this disease, analyses were made especially in relation to the presence of carbohydrates and certain other constituents, and showed that the monosaccharides, disaccharides, and polysaccharides were all significantly higher in healthy than in diseased plants, while the pentosan content was approximately equal in both lots. The percentage of dry matter was almost uniformly found to be less in diseased than in healthy plants. Abundant soil moisture and a high water content were both found to be favourable to the development of tipburn.

The results of field observations denote that high temperatures encourage, but do not cause tipburn, which may be avoided by a proper adjustment of the soil moisture. The disease may occur, however, when the relative humidity is high and transpiration is below normal.

These data are regarded as contradicting, in some measure, the above-mentioned view that excessive transpiration is responsible for the disease [as in the case of a certain type of tipburn of potato: see this *Review*, iv, p. 28]. In a further test, six out of ten lettuce plants grown under bell jars in a humid atmosphere contracted tipburn, which in this instance could certainly not be ascribed to excessive transpiration.

SANDSTEN (E. P.). **Report of Horticulturist.**—*Thirty-eighth Ann. Rept. Colorado Agric. Exper. Stat. for the year 1925*, pp. 30–34, 1925. [Received May, 1926.]

The following reference is of interest in this report. The results of field and greenhouse experiments on tipburn of lettuce [see preceding abstract] indicate a correlation between the disease and the water content of growing plants. Higher percentages of water, with corresponding succulence of the tissues, seem to induce the condition, which is reduced, on the other hand, by a higher proportion of dry matter, involving hardness or solidity of the tissues.

FLACHS. **Ist eine Bekämpfung des Sellerierostes durch Bespritzung mit Fungiziden möglich?** [Is it possible to control Celery rust by spraying with fungicides?]—*Prakt. Blätter Pflanzenbau u. Pflanzenschutz*, iii, 12, pp. 287–288, 1926.

During the summer of 1925 a series of experiments was conducted by the Bavarian Agricultural Institute in the control of celery rust [*Puccinia apii*], which is stated to have caused serious and increasing damage in the Freising district since 1916. Excellent results were obtained by two applications of 2 per cent. Bordeaux mixture or 2 per cent. soda solution, the first being given on 7th August, when the disease began to appear, and the second twelve days later. Probably the best plan is to give the Bordeaux mixture first and the soda for further applications, the latter being completely harmless to the foliage.

PFEIFFER. **Die Bekämpfung der Spargelschädlinge.** [The control of Asparagus pests.]—*Die Kranke Pflanze*, iii, 3, pp. 47–49, 1926.

Diseases and pests of asparagus are stated to be assuming a serious character in the Lössnitz district of Saxony. Rust [*Puccinia

asparagi], which causes heavy damage to the foliage, is stated to be readily controllable by the removal of all infected material and by the application, at fortnightly intervals from early July onwards, of 1 per cent. Bordeaux mixture.

Spray calendar for Grapes.—*New Jersey Agric. Exper. Stat. Circ.* 183, 2 pp., 1 fig., 1926.

The following spray schedule for the control of black rot [*Guignardia bidwellii*] and other fungous diseases and insect pests of the vine supersedes that recommended in Circular 166 of the New Jersey Agricultural Experiment Station. (1) When new shoots are 8 to 12 inches long: Bordeaux mixture 4–5–50. (2) Just after blossoms fall: the same, plus 2 to 3 lb. lead arsenate per 50 galls. of mixture. (3) Ten days after (2): same as (2). (4) From 10 to 14 days after (3) and at similar intervals till 10th August: 4–5–50 Bordeaux mixture.

SCHNEIDER (G. A.). **Erfahrungen in der Rebschädlingsbekämpfung.** [Experiments in the control of Vine pests.]—*Nachr. über Schädlingsbekämpf.* (formerly *Nachrichtenbl. Landw. Abteil. Farbenfabriken vorm. F. Bayer & Co., Leverkusen bei Köln-am-Rhein*), i, 1, pp. 5–7, 1926.

The writer has obtained excellent results in the control of downy mildew of the vine (*Peronospora*) [*Plasmopara viticola*] with the copper-arsenic preparation nosprasen [see this *Review*, v, p. 79], at a strength of 1·5 per cent. for the first application and 2 per cent. for subsequent ones. This preparation is stated to be extremely efficacious also against insect pests. Judging by the results of preliminary trials, nosperit (a dust prepared by the Höchster Farbwerke) promises to surpass all other dry treatments tested for downy mildew.

PEPPIN (S. G.). **Report of the Dominion Field Laboratory of Plant Pathology, Charlottetown.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 19–27, 3 figs., 1925. [Received June, 1926.]

The experiments conducted at Charlottetown (Prince Edward Island) were mainly directed towards the solution of various problems in connexion with the production of seed potatoes. Common scab (*Actinomyces scabies*) was only partially controlled by the use of inoculated and common sulphur. It can now be positively stated that on land which has been treated with the so-called 'mussel mud' (mud from old oyster and mussel beds, containing a high percentage of lime) for the correction of extreme acidity, potatoes should not be grown for periods ranging from 25 to 45 years or more, owing to their liability to scab.

Experiments were carried out to test the comparative value of spraying and dusting in the control of late blight (*Phytophthora infestans*) on Green Mountain and Irish Cobbler potatoes. The incidence of late blight was higher in the dusted than in the untreated plots, probably owing to the greater succulence of the dusted plants at the critical time for infection. No disease was found in the plots thoroughly sprayed with Bordeaux mixture.

GÜSSOW (H. T.). **The Dominion Field Laboratory of Plant Pathology at Fredericton, N.B.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 27–28, 1925. [Received June, 1926.]

In continuation of previous experiments in the control of club-root of turnips [*Plasmodiophora brassicae*] thirty varieties were tested for resistance on infected soil. Judging from this one year's experience, the only variety exhibiting a marked degree of resistance is May Turnips (12·1 per cent. severe and 9·1 per cent. slight infection), but it is hoped that further tests may be carried out with this variety and eleven others giving some indication of resistance. Eighteen varieties, including several types of Bangholm and Purple Top, and Yellow Tankard showed 100 per cent. infection.

BERKELEY (G. H.). **Report of the Dominion Field Laboratory of Plant Pathology, St. Catherine's.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 32–39, 1925. [Received June, 1926.]

A survey of the Niagara peninsula made during the summer of 1924 showed that mosaic is prevalent on purple and black, as well as red raspberries, while certain varieties of blackberries are also slightly susceptible. Infection has been found on 26 varieties of raspberries, including Cuthbert, Marlboro, Herbert, Seneca, June, Newman '23, St. Regis, Latham, Cumberland, and Plum Farmer, and the writer knows of no immune variety. The disease is particularly severe in the Port Hope and Newcastle districts. In 1924, 33 growers with a total acreage of 51·5 acres received certificates to the effect that their raspberry stocks were sufficiently healthy to serve for planting purposes. No patches were certified that contained more than four or five mosaic bushes per acre before roguing.

The incidence of raspberry leaf curl in the Niagara peninsula is stated to be decidedly on the wane, the annual count of infected bushes being generally very small.

Severe attacks of strawberry root rot or winter injury were recorded throughout Ontario, especially on new settings, during the summer of 1924. Isolations from diseased material from widely separated localities have uniformly yielded *Fusarium* spp., and in some cases bacteria similar to those found on strawberry roots in 1923. Transverse sections through affected plants have shown abundant mycelium in the woody elements. These data point to the possibility of a species of *Fusarium* being involved in the causation of the disease.

BAILEY (D. L.). **Report of the Dominion Field Laboratory of Plant Pathology, Winnipeg, Man.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 39–50, 1925. [Received June, 1926.]

Eighty-three standard and specially selected varieties of oats were grown in rod rows for a rust (*Puccinia graminis avenae*) resistance test at four different places. The results of the experiment [presented in tabular form] indicate that only eight of the

varieties are resistant. Five of these, namely, Richland, Heigira Rustproof Selection, Selection of Monarch Selection, Minnesota No. 437, and Minnesota No. 439, belong to *Avena sativa*, while the other three, viz., White Tartar, White Russian, and Green Mountain (which are considered to be identical and will henceforth be known as White Tartar) are *A. orientalis*. In these experiments attention was also paid to the reaction of the varieties to crown rust (*P. coronata*) [*P. lolii*]. Owing to the scarcity of infection the results of the test cannot be regarded as final, but the marked susceptibility of Richland was demonstrated.

In 1924 pycnidia of *P. graminis* were first found on barberries at Winnipeg on 17th June. The first collection of the uredo stage was on wheat in southern Manitoba. For about a fortnight the weather conditions favoured rust development and by 26th July the disease was widespread. The average reduction in wheat yield in Manitoba as a result of stem rust is estimated to have been 10 per cent. or 5,000,000 bushels.

Thoroughly satisfactory control of bunt (*Tilletia tritici* and *T. levis*) was given only by the standard formaldehyde sprinkle (1 in 320) and the germisan dip (30 minutes in a 0·25 per cent. solution).

The data obtained from a large number of isolations from the roots of wheat affected with root rot in various localities of Manitoba indicate the widespread association of *Helminthosporium sativum* and *Fusarium* sp. with the disease. Extended greenhouse studies further denoted that these were the only virulent organisms occurring on the roots.

CONNERS (I. L.). **Report of the Dominion Field Laboratory of Plant Pathology, Brandon, Man.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 51–64, 1925. [Received June, 1926.]

Experiments on the control of bunt of Marquis wheat (*Tilletia tritici* and *T. levis*) and covered smut of hull-less (Liberty) oats (*Ustilago levis*) were conducted on the lines of those previously described [see this *Review*, iv, p. 31]. The results [which are presented in tabular form] indicate that the best control of bunt was given by the formalin dip (five minutes' immersion in a 1 in 320 solution), Corona copper carbonate dust, and a mixed monohydrated copper sulphate and calcium carbonate dust (both at 3 oz. per bushel), all of which reduced infection from between 20·3 and 51·4 per cent. to a trace or nil. Sulphur dust (6 oz. per bushel) proved unequal and unsatisfactory in its action, and semesan and chlorophol (one hour in 0·3 per cent. solutions) were less effective than in the previous year.

The copper carbonate and sulphur dusts gave the best control of oat smut, reducing infection from between 22·4 and 60·8 per cent. to a trace. The mixed copper sulphate and calcium carbonate dust and also semesan failed to give effective control.

In further tests of the efficacy of various organic mercury and other fungicides in the reduction of infection from seed-borne diseases, sulphur dust (8 oz. per bushel) reduced the incidence of *Ustilago hordei* on barley from 8·3 to 0·9 per cent., treatments with semesan, uspulun, germisan, chlorophol, and various copper and

nickel carbonate dusts [the results of which are presented in tabular form] being relatively ineffective. Somewhat disappointing results were given by the organic mercury compounds against this smut and also against wheat bunt and *U. levis* on oats, semesan (0·3 per cent.) being a complete failure, uspulun (0·25 per cent. immersion or 0·5 per cent. sprinkle) rather better, and germisan (applied similarly to uspulun) giving good control of bunt only. Used as dusts, semesan and uspulun gave fair control of bunt. Promising results were given in a separate test for the control of bunt by Corona copper carbonate dusts 610, 620, and 640, and Paris green at the rate of 3 oz. per bushel, but the latter caused a marked reduction of germination.

The results of an examination of the bunt balls from separate samples of smutted wheat grain in 27 carloads from 22 localities indicated that there is no sharp delimitation of the area occupied by either species of *Tilletia*, though *T. tritici* seems to predominate in the northern and *T. levis* in the southern regions of western Canada.

The results of a preliminary test on varietal resistance to bunt in plants grown from seed contaminated with one part of spores to 100 parts of seed by weight indicated that the durums are generally least affected by *T. tritici*. The Kahla variety showed only 15 per cent. infection, compared with 82·5 per cent. in Washington Club. The emmers and einkorn were moderately susceptible.

FRASER (W. P.). **Report of the Dominion Field Laboratory of Plant Pathology, Saskatoon, Sask.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 65–71, 1925. [Received June, 1926.]

As in previous tests, the Marquis-Iumillo hybrids proved markedly resistant and Marquis-Kanred crosses susceptible to stem rust (*Puccinia graminis*). The durums, Acme, Monad, and Iumillo were resistant.

Tests of the germination of the uredospores of stem rust were made in the spring and early summer, all collections being made from *Hordeum jubatum* or wheat exposed during the winter. The spores from one of the collections on *H. jubatum* gave about one per cent. germination, but none was given by the other spores tested.

Glume blotch of wheat [*Septoria nodorum*] caused much injury in 1923. Nearly 100 per cent. germination was obtained in 1924 from spores in overwintered pycnidia of this fungus.

McLARTY (H. R.). **Report of the Dominion Field Laboratory of Plant Pathology, Summerland, B.C.**—*Rept. Dominion Botanist for the year 1924, Div. of Botany, Canada Dept. of Agric.*, pp. 72–78, 1925. [Received June, 1926.]

The losses from fungous diseases were comparatively light in British Columbia during the period under review, owing to an exceptionally dry spring and early summer. Corky core of apples occurred sporadically during the latter part of the season, the injury generally being restricted to the flesh rather than the core area in the McIntosh variety.

Losses in the apple crop from bitter pit [see this *Review*, ii, p. 164]

were far above the average, probably owing largely to the dry spring and delay in applying the first irrigation. Jonathan breakdown [see this *Review*, iv, p. 550] was also more prevalent than in the preceding season, especially on late picked Jonathans. On account of the abnormal climatic conditions the fruit reached maturity a fortnight earlier than usual.

An experiment was carried out to ascertain whether McIntosh apples, inoculated during the growing season, could carry fireblight [*Bacillus amylovorus*] through the storage period without showing any external evidence of infection. Of the 220 apples inoculated, 133 were rendered unmarketable by decay due to the fireblight organism.

A severe outbreak of gum spot or drought spot of prunes occurred in very dry orchards or those suffering from excessive seepage in the Vernon area.

Phoma rot of beets [*P. betae*] occurred in the form of a crown injury to 'stecklings' (seed-bearers) of the long red mangel. Affected crowns showed a superficial dead area, and many of the buds were killed or damaged. The yield of the seed crop was reduced by 50 to 75 per cent.

A disease of tomatoes believed to be new to British Columbia was observed in the midst of one of the large growing areas in the Okanagan Valley. In the most severely affected crop, covering about one acre, production was reduced by some 75 per cent. The first symptoms, which were observed about 20th June on the Earliana variety, consisted of a sudden wilting of leaflets or whole leaves, followed by discoloration, shrivelling, and dropping of the affected organs. Defoliation of one side of the plant is a characteristic symptom of the disease, the progress of which is rather slow, several weeks elapsing before death supervenes. Small, sunken, brown patches, sometimes accompanied by longitudinal cracks, occur on the stems and petioles of the plant where leaves or leaflets have been destroyed. Cross-sections through the stem and petioles revealed a brown discoloration of the pith and xylem tissues. Inoculation tests indicated that the disease spreads more rapidly in the pith, travelling up and down the stem from the point of infection and passing into the xylem vessels. Complete disintegration of the pith was observed in badly affected plants. The brown tissues were found, on microscopic examination, to contain minute, rod-shaped, apparently non-motile bacteria, measuring 0·5 to 1·3 μ, the cultural characters of which are described, together with the technique of isolation and inoculation. A comparison of this organism with the description of *Aplanobacter michiganense* [see this *Review*, ii, p. 347] indicated that the two are identical. Inoculation experiments with this organism, conducted during the summer on plants of varying ages, were successful. There was apparently no difference in the pathogenicity of the organism when inoculated into any part of the plant above the ground. Tests of other bacteria isolated from the affected plants gave negative results.

SACKETT (W. G.). **Report of the Bacteriologist.**—*Thirty-eighth Ann. Rept. Colorado Agric. Exper. Stat. for the year 1925*, pp. 16–20, 1925. [Received May, 1926.]

This report contains the following references of phytopathological

interest. A disease of the Wragg cherry, characterized by brown spots on the leaves and by watery, green (later black and sunken) lesions on the unripe fruit, which eventually becomes mummified, has been shown to be caused by a hitherto undescribed, yellow, viscid, motile, rod-shaped micro-organism, to which the name *Phytomonas* (*Pseudomonas*) *cerasi wraggi* n. sp. has been given. The symptoms on both foliage and fruit can be considerably reduced by spraying with Bordeaux mixture or lime-sulphur, but this practice involves an undesirable dwarfing of the treated organs.

Several bacteria were found to be associated with crown or root rot of lucerne, and one at least produced a discoloration of the root when inoculated into healthy plants. It was found impossible, however, to reproduce the wilting of stems and leaves observed in the field [see this *Review*, v, p. 472].

BARKER (H. D.). **Plant diseases and pests in Haiti.**—*Intern. Rev. Sci. and Pract. Agric.*, N.S., iv, 1, pp. 184–187, 1926.

Notes are given on the most important plant diseases in Haiti.

Cotton bacterial rot has caused severe damage to the bolls in wet seasons. They become soft, watery, and rotted at almost every stage of growth, finally turning brown or black while remaining attached to the plants. No control measures have as yet been found satisfactory.

A cotton mosaic, frequent on native varieties, is under study, especially in relation to varietal resistance and the environmental factors that affect the disease, the nature of which is obscure [see this *Review*, iii, p. 272].

Mosaic disease of sugar-cane occurs throughout the island, where it is one of the most serious crop diseases. The immune variety Uba is being grown to a considerable extent, and is giving promising results. Maize mosaic is also very prevalent and destructive.

Kernel smut [*Sphacelotheca sorghi*] of sorghum causes heavy losses which may amount to 50 per cent. of the grain, the average loss being about 10 per cent.

Mosaic is the most serious tobacco disease in Haiti. Several varieties of beans (particularly the Red Kidney) are also liable to serious damage from mosaic disease.

Black rot [*Ceratostomella fimbriata*] of sweet potato is stated to be constantly in evidence, and may cause losses of 90 per cent. of the crop.

A brief description is given of the symptoms of a black rot of pineapple which develops on nearly ripe fruits and agrees with the accounts of a similar disease in the West Indies [see this *Review*, iv, p. 528]. There are no external indications of the disease, which is characterized by brownish spots in the placentae or by brownish strands in one or more of the eyelets, spreading until the entire eyelet, and in severe cases the whole of the interior of the fruit, is affected. Extensive experiments are now being made to ascertain the cause and to discover an adequate means of control.

RIVERA (V.). **Trasformazioni indotte dai raggi X in tessuti tumorali vegetali.** [Transformations induced by X-rays in the tissues of plant tumours.]—*Riv. di Biol.*, viii, 1, pp. 1–15, 4 figs., 1926.

In continuation of his previous investigations [see this *Review*, v, p. 216], the writer has made a further study of the changes induced in the tissues of crown gall tumours due to *Bacterium tumefaciens* in *Pelargonium* plants by the action of X-rays.

It was found that irradiation of such tumours caused the formation, in the body of the tumour, of distinct spherical zones composed of living cells, with a large nucleus or sometimes several, protected by a covering of dead cells. These arise from the meristem of the tumour which, under the action of the rays, considerably modifies its ordinary type of proliferation.

The death of the tumour from irradiation is a result of the excessive proliferation of the small cells and the accumulation of starch by the large ones.

MATTEI (G. E.). **La variegatura delle foglie è dovuta a batterii?** [Is leaf variegation due to bacteria?]—*Riv. di Biol.*, viii, 1, pp. 41–61, 4 figs., 1926.

The writer's researches on variegation of the foliage and flowers in cultivated plants [details of which are given] have convinced him that the phenomenon is of pathological origin, due to bacteria or other micro-organisms. The condition is stated to be transmitted by asexual propagation and sometimes by the seed (as in the case of *Pharbites, Mirabilis*, &c.). The spontaneous variegation occurring occasionally, e. g., in *Arum italicum* and the constant type observed in *Cyclamen neapolitanum* are probably due to the same cause.

ALLEN (RUTH F.). **Cytological studies of forms 9, 21, and 27 of Puccinia graminis tritici on Khapli emmer.**—*Journ. Agric. Res.*, xxxii, 8, pp. 701–725, 9 pl., 1926.

The author has carried out a complete cytological study of the specialized forms of IX, XXI, and XXVII of *Puccinia graminis* [see this *Review*, ii, p. 158; v, p. 350] in their parasitic life on the Khapli variety of emmer wheat, a variety which is known to be highly resistant to all forms of stem rust.

The three forms were found to differ considerably from each other in various physiological particulars, especially in their effect on the cells of the host. These differences are described in detail, and are also given in the form of tables.

ROUSSAKOV (L. F.). **Из исследований по ржавчине хлебов в Амурской губ. в 1925 г.** [Notes on a survey in 1925 of the incidence of cereal rusts in the Amur government.]—*Morbi Plantarum*, Leningrad, xiv, 4, pp. 128–136, 1 fig., 1926. [German summary.]

The present report is based on investigations carried out by the author on the occasion of a visit in 1925 to the government of Amur, where *Puccinia graminis* f. *tritici* and *P. triticina* are stated to be endemic. The worst epidemic of these rusts of recent years was experienced in 1923, when the wheat crop over the whole

of the vast area included in the Amur and Primorskaya governments [Siberia] and in North Manchuria was reduced to less than a quarter of the normal yield. A detailed examination of the rusts on the various organs of the host indicated that in the Amur government infection usually starts at the apical portion of the plants, gradually decreasing in intensity towards the base. The winters are extremely severe and long, so that winter cereals are not sown, and alternate hosts of the rusts, more particularly the barberry, are practically non-existent. These considerations, together with the fact that the aecidial stage of rusts is usually found in this region late in the season, after the wheat has attained Gassner's immunity stage, lead the author to believe that spring infection of the local wheat is probably caused by spores brought from far distant places by air currents.

Gassner (G.) & Rabien (H.). **Untersuchungen über die Bedeutung von Beiztemperatur und Beizdauer für die Wirkung verschiedener Beizmittel.** [Investigations on the importance of the steeping temperature and duration in the effect of various fungicides.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xiv, 3, pp. 367–410, 1926.

In these experiments the first object was to elucidate, by laboratory experiments, the influence of the temperature and duration of steeping on the action of various fungicides on wheat grain infected with bunt [*Tilletia tritici* and *T. levis*]. The methods [which are fully described] were similar to those used by Gassner, Riehm, and others [see this *Review*, ii, pp. 551–557; iv, p. 231] for the determination of the chemotherapeutical factors for the various substances at different temperatures and over different periods.

The *dosis curativa* for germisan was determined in water at temperatures of 0°, 15°, and 30° C. and for periods of 10 minutes, 1 hour, and 6 hours. As the temperature rose and the duration of immersion was increased, the *dosis curativa* was reduced (e.g., from 0·6 at 0° for 10 minutes to 0·008 at 30° for 6 hours). Similar results were obtained where the spores were germinated on soil or calcium nitrate (preceded in the latter case by rinsing with hydrochloric acid after disinfection). These data show that both the duration and temperature of steeping act in the same direction.

Similar data were obtained for the *dosis toxica*, longer periods of immersion increasing the injury to the grain much more rapidly at high than at low temperatures. The *dosis toxica* falls with a rise in the steeping temperature, the damage caused by the latter being more pronounced the longer the period.

It is shown that the action of germisan is much more marked than that of uspulun at the same concentrations when the duration of steeping is increased and, according to the data supplied, when the temperature of the disinfectant is raised. With uspulun the *dosis curativa* was scarcely influenced by temperature. As a result, whereas the chemotherapeutical index in germisan is improved by lengthening the period of steeping and increasing the temperature, with uspulun the opposite is the case.

Segetan-neu showed at a temperature of 0° that the length of steeping had no influence on the chemotherapeutical index. At

higher temperatures, a protraction of the steeping period had the same effect on the chemotherapeutical index as with uspulun. Segetan-neu is stated to possess a most favourable chemotherapeutical index (0·08 at 0°) and to suffer no loss of toxicity in the soil.

Both the *dosis curativa* and the *dosis toxica* of formaldehyde were found markedly dependent on the temperature and duration of steeping. The most favourable index (0·50) was obtained from the longest period (6 hours) at 30° and the least advantageous (8·67 and 11·42 in water and soil, respectively) from 10 minutes at 0°.

After discussing at some length the dependence of the steeping action on the duration and temperature of disinfection; the importance of steeping duration and temperature in the chemotherapeutical evaluation of disinfectants; and some further conclusions arising out of the present and previous investigations, the writers describe a number of other tests on the effect of temperature on fungicidal action, in which, instead of laboratory experiments on the spores with subsequent washing out of the fungicide, heavily infected wheat was steeped for one hour at varying temperatures and dried at the same temperatures without rinsing. Both formaldehyde and germisan, the action of which is poor at low temperatures, showed a considerable increase of efficacy on prolongation of the steeping period, whereas a steeping temperature of 5° to 6°, or even of 3° to 4°, did not produce appreciably inferior results to temperatures of 16° to 18° or 30°. The reason for this is that the fungicide continues its action during the drying period, which is naturally long at low temperatures and short at high. The results of these tests were confirmed by field experiments, which indicated that the temperature of the disinfectant is of no practical importance under ordinary conditions of farming practice either for sprinkling or immersion.

NEILL (J. C.). **Stinking smut of Wheat. IV. Experimental results for season 1925–26.**—*New Zealand Journ. of Agric.*, xxxii, 4, pp. 233–235, 1 fig., 1926.

In 1925–6 the author continued his investigations on the control of bunt (*Tilletia tritici*) in New Zealand [see this *Review*, iv, p. 659].

A table is given showing the germination percentage and bunt percentage for each of the seed treatments tested, namely, dusting with copper carbonate, two strengths, at 2 oz. and 4 oz. per bushel, respectively; steeping in copper sulphate solution, 1 lb. in 10 galls., and 1 lb. in 5 galls.; steeping in formalin 1 pint to 40 galls. (1 in 320), and 1 pint in 60 galls. (1 in 480), with and without presoaking; steeping in Clarke's wheat protector, 7·7 per cent. solution; dusting with Corona 640 and 640 S, at 3 oz. and 6 oz. per bushel, respectively; dusting with Dupont 13 and 30 dusts, 3 oz. per bushel; dusting with dry semesan, 1 oz. per bushel; steeping in semesan, 0·2 per cent. solution for 1 hour; steeping in uspulun, 0·25 per cent. solution; and steeping in germisan, 0·25 per cent. solution.

The results, in general, confirm those given in previous tests. The formalin steep and copper carbonate dust treatments stand out

as the best under present conditions. Formalin at a strength of 1–320, however, proved detrimental to the vitality of the seed, whilst the presoaked 1–480 treatment gave less harmful results.

The higher grade copper carbonate dust, containing 54 per cent. copper and used at the rate of 2 oz. per bushel, gave complete bunt control, and, on the whole, a slight improvement in the number of plants and heads as compared with the untreated seed. The product containing 26 per cent. copper and used at 4 oz. per bushel was less effective and slightly damaged the seed. The copper sulphate steep, although effective in controlling bunt infection, caused much damage to the seed.

Both the dust and steep semesan gave nearly complete control with a slight increase in the number of heads harvested. Uspulun and germisan gave results somewhat less satisfactory than in the preceding year, due possibly to deterioration of the preparation on keeping. Clarke's wheat protector, although very effective as regards bunt control, was liable to damage the seed. The two new disinfectants tested, Corona and Dupont dusts, are not yet beyond the experimental stage. At present they appear to be less effective than the copper carbonate dust.

ELENEFF (P. F.). Культурно-хозяйственные мероприятия для борьбы с выпреванием озимых хлебов. [Agricultural measures for the control of winter injury to autumn-sown cereals.]—*La Défense des Plantes*, Leningrad, iii, 1, pp. 39–42, 1 fig., 1926.

Autumn-sown cereals in central Russia are stated to suffer severely, outside the black soil wheat belt, from the so-called winter injury usually ascribed by West European and American phytopathologists to the action of *Fusarium nivale* (*Calonectria*) [*graminicola*]. The author's observations since 1917 lead him, however, to consider that the trouble is primarily due to the action of unfavourable climatic, topographical, and agricultural conditions which during the winter tend to lower the vitality of the plants, thus rendering them highly susceptible to the attacks of parasitic fungi in the spring. It was observed that the injury is worst in places where small irregularities of the surface of the soil, or the presence of shrubs or trees in the fields, tend to form deep accumulations of snow [see also this *Review*, v, p. 290], or where water from melting snow in the spring persists for any length of time, while on level surfaces and well-drained plots the injury is minimized. In the present very low state of agriculture in Russia, when proper tillage is neglected and the fields are infested by weeds, the usually recommended treatment of the seed grain against the trouble is of no avail, as the spores of the parasitic fungi involved are always present in the soil. The chief efforts should therefore be directed towards careful levelling of the surface of the soil and proper drainage of the fields, detailed instructions for which are given.

Besides *F. nivale*, in north and central Russia winter injury is largely caused by *Sclerotinia graminearum* Eleneff, which attacks both wheat and rye. This fungus is very widespread in the north, where it kills large, continuous areas of the crop, while in the centre of the country its attacks are more patchy; in both regions the

plants infected by it never recover, as they do sometimes when attacked by *F. nivale*. *S. graminearum* also infects many wild Gramineae, more particularly rye grass (*Lolium perenne*) which is rapidly killed by it. A third organism also involved in this type of disease is *Sclerotium nivale* Eleneff, which is widespread on wild grasses and occasionally attacks rye. Under the present conditions in Russia *F. nivale* is very prevalent on wheat, but the author has seldom observed it attacking wild Gramineae.

DOUNIN (M.). **The fusariosis of cereal crops in European Russia in 1923.**—*Phytopath.*, xvi, 4, pp. 305–308, 1926.

A poisoning due to the consumption of rye bread (the 'inebriant bread' of various writers), which occurred chiefly in the region between Lake Ladoga and Lake Onega, Russia, in 1923, was associated with an extraordinary prevalence of *Fusarium roseum* and another species of *Fusarium* on the grain, due to the abnormally cloudy and wet summer weather. Oats and barley were affected to a slighter extent. The consumption of the resulting bread induced symptoms of weakness, vertigo, headache, and nausea. In 65 per cent. of the infected grains examined the fungus was found to be dead.

It was ascertained that the only way in which the pathogens could be killed without damaging the grain was by drying the latter at a temperature of 46° to 54° C. for 12 to 18 hours in the specially constructed sheds used by the local peasantry.

It was shown that most of the kernels become infected after harvesting when the sheaves are kept in stooks in the field. The mycelium is found chiefly in the superficial strata at the ends of the kernels. The percentage of infection in the different parts of the kernels is shown in tabular form.

Information concerning 'inebriant' linseed oil was received from the Gomel region, and on examination the affected flax seed was found to be invaded by a species of *Fusarium* differing in morphological and cultural characters from *F. lini*. The symptoms induced by the consumption of oil from affected seed were similar to those caused by the diseased bread.

CHRISTENSEN (H. R.). **Om Gulsspidssygen og dens Bekæmpelse.** [On yellow tip disease and its control.]—*Ugeskr. for Landmaend*, lxx, 36, pp. 561–565, 5 figs., 1925.

An account is given of Hudig's work in Holland on the control of yellow tip disease of oats [see this *Review*, iv, p. 342] by the application of a mixture of peat ash, household refuse, urban compost, and street sweepings at the rate of 5,000 kg. per hect. The results of this treatment were eminently satisfactory, as were also those of applying copper sulphate at the rate of 50, 66, or 100 kg. per hect. Both methods were successfully used by the writer in Denmark.

JEHLE (R. A.), OLDENBURG (F. W.), & TEMPLE (C. E.). **Relation of internal cob discoloration to yield in Corn.**—*Phytopath.*, xvi, 3, pp. 207–215, 1 fig., 1 map, 1926.

Root, stalk, and ear rot diseases of maize [of the types variously

attributed to toxic iron and aluminium compounds and to organisms such as *Diplodia zeae*, *Gibberella saubinetii*, *G. moniliformis*, and *Cephalosporium acremonium*: see this *Review*, iii, pp. 32, 208; iv, pp. 665, 732] are stated to be very prevalent in Maryland, causing an estimated annual loss of 10 per cent. of the crop, or some 2,500,000 bushels. The results of 90 tests conducted over a period of four years gave the following indications as to the correlation between cob discoloration and yield. Other conditions being similar, the yield from seed grain taken from cobs free from discoloration is greater than that from seed from cobs with internal discoloration. The difference in yield is greater on poor sandy and clay soils than on better land. Internal cob discoloration can be decreased by selection, and has been almost eliminated in four years by planting seed from healthy ears [see this *Review*, iv, p. 264]. Maize grown from ears with the slightest amount of internal discoloration seems to have a more uniform stand, a smaller number of fallen and broken stalks, and fewer prematurely killed plants than that grown from ears with the highest incidence of this affection.

ROSEN (H. R.). **Bacterial stalk rot of Corn.**—*Phytopath.*, xvi, 4, pp. 241–267, 5 figs., 1926.

A full description is given of the symptoms, distribution, and mode of infection of bacterial stalk rot of maize [see this *Review*, i, p. 170], and of the morphological and cultural characters and physiological reactions of the pathogen, for which the name *Phytomonas dissolvens* comb. nov. [*Bacterium dissolvens* in Migula's classification] is proposed.

In Arkansas, where observations on its occurrence have been made, for the past six years, stalk rot is considered to be serious only during periods of abnormally high rainfall and humidity. The symptoms of the disease, which may be described as a localized necrosis of the parenchymatous tissue, include a light or dark brown decay of the leaf bases, especially of those at the base of the stalks, and a rotting of the lower portion of the stalk, the affected part being dark brown, soft, putrid, and sunken in fresh infections, which appear as dark spots with water-soaked margins.

An account is given of a number of successful artificial infections, including some obtained in the so-called Hottes chambers (a series of large glass compartments in which air and soil temperatures can be accurately controlled). Temperature was found to play an important part in the inception and development of the disease. No infections occurred below 20° C.; very few between 20° and 25°; between 25° and 30° the number and extent of the lesions were greater; while the climax was reached between 30° and 35°, at which point the affected area showed the maximum amount of disintegration and death of the tissues. High humidity was also found to be essential to infection, and a correlation was noted between rapid, succulent growth and disease susceptibility.

Infections were found to take place through hydathodes, stomata, through the weak spots resulting from the extrusion of endogenous roots, and through insect wounds.

Tisdale (W. H.) & Johnston (C. O.). **A study of smut resistance in Corn seedlings grown in the greenhouse.**—*Journ. Agric. Res.*, xxxii, 7, pp. 649–668, 3 pl., 1926.

An account is given of experiments conducted at Arlington, Virginia, and Manhattan, Kansas, to test varietal and strain resistance of maize seedlings to smut (*Ustilago zeae*) under greenhouse conditions.

Fresh cultures of *U. zeae* in carrot decoction were found to be a more satisfactory inoculum than chlamydospores or than conidia from cultures on solid media. The most effective method of inoculation was the injection of a conidial suspension hypodermically, the seedlings being grown under conditions of high temperature (80° to 95° F.) and humidity. Fairly satisfactory results were obtained in some instances by dropping the inoculum into the apical buds, but spraying with a spore suspension has given poor results.

The virulence of the fungus varied somewhat according to the source of the cultures used. The relative resistance or susceptibility of the strain of maize tested was, in general, the same under greenhouse seedling conditions as in the field, provided the inoculations were made after the three-leaf stage. At an earlier stage, the resistant forms may be infected, but in some cases the infection is slight and often fails to produce galls. Susceptible plants were frequently killed when infected.

The practical value of this method in the production of smut-resistant varieties of maize is indicated.

Dickson (J. G.). **Making weather to order for the study of grain diseases.**—*Wisconsin Agric. Exper. Stat. Bull.* 379, 36 pp., 9 figs., 11 graphs, 1926.

After a general discussion on the importance of meteorological conditions in relation to plant diseases, and on the necessity of a scientific basis for crop improvement, the writer describes the uses of the Wisconsin soil temperature tanks [see this *Review*, iv, p. 50] in the study of fungous infection and the testing of resistant varieties. The correlation between the incidence of various diseases and soil and temperature conditions is illustrated by references to seedling blight of wheat and maize [*Gibberella saubinetii*: see this *Review*, v, p. 247], oat smut [*Ustilago avenae* and *U. levis*], and stripe disease of barley [*Helminthosporium gramineum*] as affected by climatic factors [see also this *Review*, iv, p. 656]. The incidence of stripe was more than doubled in 1925, when the soil was cool and wet, as compared with 1922, when the seed was sown in moderately dry soil. The best temperature for the growth of barley seedlings appears to be 55° F. The amount of oat smut in plots sown in moist soil (which subsequently became dry) at 60° in 1923 was 56 per cent., compared with only 1 per cent. in moist, cool soil at 52° in 1925.

Dickson (J. G.) & Holbert (J. R.). **The influence of temperature upon the metabolism and expression of disease resistance in selfed lines of Corn.**—*Journ. Amer. Soc. Agron.*, xviii, 4, pp. 314–322, 1 fig., 3 graphs, 1926.

In continuation of the first-named writer's previous physiological

and chemical investigations on disease resistance in plants [see this *Review*, v, p. 247], (which are here briefly recapitulated), the authors have studied the influence of temperature on metabolism and resistance in selfed lines of maize.

The results of two years' preliminary studies on self-pollinated strains selected for seven and eight years and on hybrids between these strains indicate that resistance to seedling blight (*Gibberella saubinetii*) is an inheritable characteristic, the expression of which is constant over a given temperature range for each strain. Certain of the more resistant strains remain resistant to seedling blight until the temperature falls below 12° C., when they become predisposed to the disease. The temperature response in different strains varies from that of strains which are resistant to blight at temperatures from 32° to 12°, to that of strains susceptible at all these temperatures. Both these types of strain germinate and grow in a clean soil at temperatures down to 10°. Hybrids between these resistant and susceptible strains are susceptible at all temperatures.

The metabolism of the resistant strains was found to follow a parallel course to that of open-pollinated maize, the average material of which was found to be subject to seedling blight at temperatures below 24°. The latter was low in hexose and soluble, polysaccharide-building substances below 24°, with a rapid rise above this temperature and subsequent drop above 32°. The curve for total pentosan content was just the reverse of this soluble-carbohydrate curve. The resistant selfed strains were low in building substances below 12°, with a rapid rise to the highest plane at 16°. The curve for total pentosan content was again just the reverse of this one. These marked changes in metabolism therefore occur, in both cases, at the same temperature as predisposition to disease.

The composition of the resistant strains is also comparable to that of the open-pollinated maize. The curve for nitrogen content and its relation to total carbohydrates has a similar trend to that of the open-pollinated seedlings, while the curves for reducing sugars and sucrose are also analogous. In each case, however, the marked changes occur between 12° and 16° in the resistant selfed material instead of at 24° as in the open-pollinated plants. The metabolism of the resistant plants, therefore, appears to be stabilized and to extend over a wider temperature range than that of the open-pollinated maize.

The metabolism of the susceptible selfed strain differs markedly from that of either the resistant or open-pollinated plants. The soluble. carbohydrate-building substances increase with the rise in temperature, due to an accumulation of reducing sugars. There is further a decrease in sucrose content in the susceptible strains with the rise in temperature, compared with a noticeable increase in both the resistant and open-pollinated strains. The pentosan content of the susceptible strains drops at 16° and rises abnormally with the increase in temperature, indicating easily hydrolysable cell walls, which were shown by micro-chemical examination of the protective sheath tissues to consist of intermediate cellulose compounds with little or no impregnation by suberin. In the resistant strains, on the other hand, suberin was found in abundance in the cortical cell walls.

The explanation of susceptibility in the case under investigation would appear to be the existence of a state of unbalanced metabolism, due to some deficiency in the genetic constitution and affecting the chemical composition of the plant.

KENDRICK (J. B.). **Holcus bacterial spot on species of Holcus and Zea mays.**—*Phytopath.*, xvi, 3, pp. 236–237, 1926.

The variability of the *Holcus* bacterial spot on different hosts is thought to be responsible for much confusion in the literature as to the identity of the causal agent. On all the hosts the lesions are round, oblong, linear to irregular, and of varying dimensions. On sorghum (*Holcus* [*Andropogon*] *sorghum*), Sudan grass (*H.* [*A.*] *sorghum* var. *sudanensis*), and Johnson grass (*H.* [*A.*] *halepensis*), the spots are red or light centred with a red border, except in the Shallu variety of sorghum, on which the border is dark brown. On pearl millet (*Pennisetum glaucum*) [*P. typhoideum*] the lesions are dark brown with a slight halo, while on maize they are light to dark brown with a reddish-brown border and a pale green halo when seen by transmitted light. The spots on foxtail (*Chaetochloa* [*Setaria*] *lutescens*) are small and dark brown.

A white, fluorescent bacterium has been consistently isolated from diseased material and proved by cross-inoculation experiments and cultural studies to be identical on the different hosts. The organism has been determined as a new species, *Bacterium holci*, the morphological and cultural characters of which are described. The organism is a short, cylindrical rod, measuring 0·73 by 2·13 μ, with one to four polar flagella at one pole only, strictly aerobic, and Gram-negative. Gelatine is rapidly liquefied and nitrates reduced. The temperature growth range is 0° to 35° C., optimum between 25° and 30°, and thermal death point 49°. The group number is 211.2323133.

RÖSCH (A.). **Studien über den Haferflugbrand, Ustilago avenae (Pers.) Jens. und den Glatthaferbrand, Ustilago perennans Rostr., mit besonderer Berücksichtigung der Immunitätsfrage beim Haferflugbrand.** [Studies on loose smut of Oats, *Ustilago avenae* (Pers.) Jens. and the smut of smooth Oats, *Ustilago perennans* Rostr., with special reference to the question of immunity from loose smut.]—*Bot. Arch.*, xiii, 5–6, pp. 382–431, 5 figs., 1 graph, 1926.

The results of the author's extensive studies on the infection of oats by loose smut (*Ustilago avenae*) generally confirm those of previous investigators [see this *Review*, iii, p. 642; iv, p. 158], namely, that the spores of the fungus germinate on the open blossoms and form hyphae and gemmae in or on the tissues of the stigmas, anthers, glumes, ovary, and lodicules. On the desiccation of these organs the conidia and mycelium become transformed into gemmae and resting mycelium, which resume growth and infect the seedlings in the spring.

Seedlings of *Avena nuda* are generally infected only by the resting mycelium, gemmae, and occasional ungerminated spores on the epidermis of the caryopses. Late infection of this species is, however, also liable to occur through spores blown on to the hull-less seeds during threshing operations, which come into contact

with and infect the seedlings in the following spring. In view of the great susceptibility to the disease of many species of hull-less oats, this mode of infection is thought to be of considerable importance.

The mycelium may invade any part of the seedling, and entry can apparently be effected through perfectly sound cells, but infection appears to result only from penetration of the first nodes or their immediate vicinity. The cessation of susceptibility in the seedling appears to coincide with the emergence of the first leaf from the cotyledonary sheath. The mycelium first penetrates into the upper cell layers, while in the interior of the seedling and in the younger tissues it only develops intercellularly. In the case of immune varieties, e.g., *A. brevis*, the hyphae make slow progress and soon become deficient in protoplasm, presumably as a result of unfavourable conditions for their development. As regards the internal development of the fungus, no difference is discernible in the initial stages between susceptible and resistant varieties. The mycelium of *U. avenae* was even shown to be capable of penetrating seedlings of wheat, barley, rye, and smooth oats (*A. elatior*), but no further growth takes place in these hosts.

In a series of field tests of the relative susceptibility of 33 commercial varieties, 500 seeds of each variety and 250 of *A. brevis* were artificially infected by a mycelial culture on fragments of glumes and anthers. The results of these experiments and those of previous workers [which are discussed and presented in tabular form] showed that Strube's Schlanstedt, Dippe's Ueberwinder, Carsten's III, and Edler's Göttingen are uniformly susceptible. Of the varieties tested by the writer in 1924 only, Neuprüfung I and II, Svalöf's Sieges, and Hörning's, Weiss's, and Kraft's Rhenish White proved very susceptible. *A. brevis* and *A. strigosa* appear to be quite immune, and v. Lochow's Yellow Oats, usually considered susceptible, proved highly resistant. Since the writer's data on varietal susceptibility agree in the main with those of previous investigators, it may be safely assumed that the mode of reaction to oat smut is an inherited characteristic.

Delay in the sowing of a portion of the infected grain resulted in a considerable increase in the incidence of smut, which is believed to be partially attributable to the higher temperatures prevailing after the later date of planting (30th April). For this and other reasons timely sowing (middle of April) is recommended as affording a certain degree of protection against loose smut. The plants originating from the inner grains [i. e., those of the second flower in the spikelet] were generally much more susceptible than those from the outer grains, this character being probably correlated with the lower germinative energy of the seedlings. Marked differences were observed under natural conditions in the extent of opening of the glumes, and these were correlated with a corresponding divergency in the degree of infection of the blossoms. The second and third blossoms are generally much wider open and remain so for a longer period than the rest. The small inner and intermediate grains, being more exposed to smut infection, should be discarded before sowing.

Loose smut of smooth oats (*Ustilago perennans*) agrees closely with *U. avenae* both in its saprophytic and parasitic existence, but

the results of the writer's germination experiments indicate that it is not identical.

During the flowering period its spores are disseminated over the open blossoms, where they rapidly germinate, forming hyphae and conidia (subsequently converted into gemmae) on the stigmas and lodicules. In the writer's tests the spores on the glumes and ovary rarely germinated. The mycelium penetrates the upper cell layers of the seedling and develops in the intercellular spaces. The hyphae persist in the underground axis of the plant and form a perennial mycelium which serves to infect the young haulms as these appear. The mycelium reaches its maximum development at the time of the formation of the panicles. In the older portions of the plants hyphal remains are generally observed only in the nodes and in the underground axis.

DUFRÉNOY (J.). **Maladies du Cédratier et du Citronnier en Corse.** [Diseases of the Citron and of the Lemon in Corsica.]—Reprinted from *Bull. Office Régional Agric. du Midi*, 26 pp., 18 figs., 1925. [Received June, 1926.]

A description is given of various diseases of the citron (*Citrus medica*) and of the lemon (*C. limonia*) in Corsica, and of the soil conditions which are held to favour their attacks and also to be generally unsuitable for the trees.

Collar canker of citron and orange (*C. sinensis*) is associated with a fungus regarded as morphologically indistinguishable from *Pythiacystis* [*Phytophthora*] *citrophthora* and *P. terrestris* [*P. parasitica*], which the author appears to consider very similar organisms. The fungus described by Moniz de Maia [*P. hibernalis*: see this *Review*, v, p. 295] is thought to be distinct from these. For the control of this disease the writer recommends that manure should not be applied directly to the roots of the trees, and advocates the use of phosphatic fertilizers; relatively shallow planting; and protection of the collar from the irrigation water by the construction of a soil barrier round the base of the trunk.

A short account is given of the desiccation of the twigs and thorns by *Phoma* spp., which produce grey or white patches, frequently dotted with minute, black spots, on the cortex. Anthracnose (*Gloeosporium limetticolum*) also causes desiccation of the twigs and the development of whitish-grey spots, covered with black dots. Neither of these diseases is of much importance under Corsican conditions.

The most common agents of decay of citron and orange fruits in Corsica, as elsewhere, are the blue and green moulds, *Penicillium italicum* and *P. digitatum*.

Sooty mould (usually *Meliola penzigi*) follows various insects, and may be controlled by the application of lime-sulphur or alkaline polysulphides.

In connexion with a discussion of cultural methods, the writer quotes Boyer as recommending the grafting of citrons on Seville oranges (*C. aurantium*) for the control of root rot on damp soils.

HARLAND (S. C.). **Wither-tip disease of Limes. Suggestions for its control.**—*Trop. Agriculture*, iii, 4, pp. 74–75, 1926.

The best method of control of wither-tip disease of West Indian

limes [*Citrus aurantifolia*] caused by *Gloeosporium limetticolum* [see this *Review*, v, p. 226] is thought to be obviously the production of an immune variety, possessing the essential features of heavy cropping, high citric acid content, characteristic flavour, and dropping of the fruit from the tree on maturity. The problem is considered under the following heads: (1) selection among the seedlings of the West Indian lime in the hope of finding an immune type; (2) a survey of the cultivated varieties of lime; and (3) artificial hybridization. Neither of the first two methods is considered very promising, although there are indications that natural crossing occurs to some extent in the spineless lime widely cultivated in Dominica (which is a mutant from the ordinary West Indian variety), since it is said to throw spiny progeny not infrequently. There is thought also to be a possibility that some of the Indian and Burmese limes which have recently been shipped to Trinidad may prove resistant. As regards the third method, it is necessary to ascertain whether the hybrids of West Indian limes and other citrus types made in Montserrat and Dominica [see next abstract] can reproduce their characters by apogamous embryos, and whether they can be back-crossed to the West Indian lime. Should this be feasible an immune type could be produced in some three generations.

Work connected with insect and fungus pests and their control. —*Rept. Agric. Dept. Dominica 1924–5*, p. 12, 1926.

Particulars are given of the plantations of new varieties of lime which it is hoped will prove resistant to wither-tip [*Gloeosporium limetticolum*: see preceding abstract]. These include Tahiti, Bear's Seedless, Sour Lime, Kusaie, Rangpur Lime, Calamondin (*Citrus mitis*), Eustis limequat, and Woglum lemon, the last-named having recently been attacked by a fungus producing symptoms similar to those of *G. limetticolum*. The foliage of most of these varieties was inoculated with *G. limetticolum* and no symptoms of infection developed, but this may have been partly due to the fact that the climatic conditions at the time were unfavourable to the growth of the fungus. There are other varieties new to Dominica in the nurseries, and these will also be tested for resistance to wither-tip.

PRATT (CLARA A.). **A disease of Queensland Cotton seed.**—*Empire Cotton Growing Review*, iii, 2, pp. 103–111, 1926.

Samples of diseased cotton seed from Queensland were received by the author in 1924. About 30 per cent. of the seeds failed to germinate, and examination of the dry seeds showed a softening and browning of the embryo in about 23 per cent. A fungus was isolated from a high percentage of these seeds and was identified by Wollenweber as *Fusarium moniliforme* [*Gibberella moniliformis*]. Three bacteria were also isolated from some of the diseased seeds, but the author's inoculation experiments, which are described in detail, have shown definitely that the *Fusarium* is the responsible agent of the diseased condition. Inoculation into ripe cotton seeds produced similar symptoms to those found in the original sample. Furthermore, the organism proved capable of attacking and rotting the roots of cotton seedlings and, when introduced into cotton bolls

on greenhouse plants by needle inoculations, the seeds of these bolls became infected.

This is believed to be the first record of *F. moniliforme* from Australia. The resemblance between the attacks of the fungus on maize grain [see this *Review*, iii, p. 31; iv, p. 732] and on cotton seed is referred to, and the possibility of the disease being associated with boll punctures due to insects is briefly discussed.

SKAIFE (S. H.). **The Locust fungus, Empusa grylli, and its effects on its host.**—*South African Journ. of Sci.*, xxii, pp. 298–308, 1 pl., 1925. [Received March, 1926.]

This is a more detailed report on the epidemic of *Empusa grylli*, which in March, 1925, destroyed whole swarms of locusts in South-West Africa [see this *Review*, v, p. 93]. Meteorological data indicate that in all districts where the locusts were killed in large numbers over 5½ inches of rain fell in at least one of the three months, January to March, during each of which it rained on 15 to 20 days or more. The records show that a rainfall of 14 to 15 inches, spread evenly over a period of three months, is sufficient to start a severe epidemic of the fungus among the locusts, while a rainfall of a little over 10 inches in the same period is not. From observations on the formation and abstriction of the conidia [details of which are given] it would appear that they are thrown off generally in the evening, when the locusts are clustered together for the night. Each conidium carries with it a small portion of the contents of the conidiophore, by which it adheres to any object against which it strikes. When weather conditions are favourable, conidia alighting on a locust germinate very rapidly by the production of a fine germ-tube which pierces the skin and enters the body, possibly by means of the solvent action of an enzyme. Conidia which fail to come into contact with locusts may, under suitable moist and warm conditions, give rise to secondary conidia which can probably infect healthy locusts, but experimental evidence to confirm this is lacking. Attempts to infect locusts artificially by feeding them with suspensions of conidia or of resting spores consistently gave negative results, while infection by contact with diseased individuals was successful in over 75 per cent. of the tests. The conidia appear to live for only about three days. In locust's blood they germinated freely and vigorously, but not in the blood from two other species of acridians, thus indicating that there are strains of the fungus adapted to particular hosts, since in South Africa all species of short-horned acridians are apparently susceptible to *E. grylli*. During the 1925 outbreak the locustid known as the 'koringkriek' or 'dikpens' (*Eugaster* sp.) was very abundant but was never found infected, although the insects mingled freely with the locusts and fed upon them to a certain extent. A small percentage of the locusts appear to enjoy complete immunity from the disease, both in laboratory experiments and in the field. The fungus develops more rapidly and vigorously, and after death conidia are produced much more abundantly, on some individuals than on others, and there is evidence that there are strains of the fungus which are much more virulent than others.

The paper terminates by pointing out the impossibility, in the

present state of knowledge, of the disease being used artificially for the control of the locusts, and by mentioning that a new parasitic fungus of the locust, a species of *Isaria* (apparently causing death of the insects in a few cases), has been discovered in South-West Africa.

GILBERT (E. M.) & KUNTZ (W. A.). **Some diseases of Aphis spiraecola Patch.**—*Quarterly Bull. State Plant Board of Florida*, x, 1–2, pp. 1–6, 1926.

The chief factor in the natural control of the citrus aphid (*Aphis spiraecola*) in Florida is stated to be the fungus *Empusa fresenii.*

Insects killed by this fungus can be recognized by their posture, since they are attached to the surface of the leaf or twig solely by the proboscis and therefore appear to be standing on their heads. They may be killed at any stage of development. After death the abdomen and thorax become coated with tan-coloured to light smoky brown, glistening conidia, the development of which is described. In the Florida citrus groves these conidia are produced for not more than two weeks after the death of the insect. In examinations carried out since March, 1925, no resting spores of this species of *Empusa* have been found, possibly because cooler climatic conditions are required for their formation.

Two other minor diseases have been found attacking these aphids. The so-called white mould is of extremely rare occurrence throughout Florida. It is caused by a species of *Cephalosporium* characterized by a cottony type of growth covering the entire body of the insect. This growth subsequently becomes powdery from a copious production of conidia. In the other disease, the 'brown mould', the affected insects are closely adpressed to the leaf and are covered with a fluffy or powdery brown mass of mycelium and spores, belonging to fungi of the genus *Cladosporium*. It is not certain, however, that these are the real cause of the death of the insects, as they appear to grow readily on insects killed by other agencies, and it has been established that none of the species hitherto found is a virulent parasite.

EREMEYEVA (Mme A. M.). **Entomophthora sphaerosperma Fres.** на гусеницах капустницы и на яблонной медянице. [*Entomophthora sphaerosperma* on the caterpillars of the Cabbage butterfly and on the Apple sucker.]—*Morbi Plantarum* Leningrad, xiv, 2–3, pp. 100–103, 1 fig., 1925. [German summary, Received June, 1926.]

The author states that in 1919 she observed in the vicinity of Kursk [Russia] a severe epidemic of *Entomophthora sphaerosperma* both on the caterpillars of the cabbage butterfly (*Pieris brassicae*) and on the apple sucker (*Psylla mali*), the latter being, as far as she is aware, the first record on this host in Russia or, indeed, in Europe. The symptoms of the disease are briefly described, and the mortality of both insects attacked is stated to have been extremely high, so much so that the apple sucker was practically wiped out and, according to reports, has not since reappeared in the region. [See also this *Review*, iv, p. 218.]

Nannizzi (A.). **Ricerche sui rapporti morfologici e biologici tra Gymnoascaceae e Dermatomiceti.** [Studies on the morphological and biological relations between Gymnoascaceae and Dermatomycetes.]—*Ann. Mycol.*, xxiv, 1–2, pp. 85–129, 4 pl., 12 figs., 1926.

This is a detailed account of the author's studies on the morphological and biological relations between the Gymnoascaceae and Dermatomycetes, a brief preliminary note on which has already been published [see this *Review*, iv, p. 735].

After a general description of the structure of the Dermatomycetes during the parasitic stage and in culture in artificial media, a full account is given of the development, on substrata of leather, birds' wings, and human hair, of *Trichophyton radiolatum*, *T. asteroides*, *T. denticulatum*, *T. felineum*, *T. equinum*, *T. granulosum*, and *Microsporon lanosum*, of which the five first named are stated to have produced fructifications analogous to the ascigerous fructifications (rudimentary perithecia) of the Gymnoascaceae, but containing pycnospores similar to the aleuriospores but rounded and borne in clusters, instead of asci.

The analogy of these organs with the ascigerous fructifications of the Gymnoascaceae was demonstrated by a study of the behaviour on artificial media of certain of these Ascomycetes, namely, *Ctenomyces serratus*, *Arachniotus candidus*, *A. aureus*, *Gymnoascus reesii*, *Myxotrichum chartarum*, and *M. uncinatum*, all of which produced simple or compound clusters, external or internal aleuriospores, fusiform chlamydospores, a net-shaped mycelium, hyphae with pyriform or racquet-shaped swellings, and spiral or dentate hyphae, recalling the similar structures observed in the dermatophytes. The resemblances between the two groups are clearly brought out in a series of figures and diagrams. In *M. chartarum* it is not uncommon to find, besides the perithecia bearing asci, others in which asci are replaced by uninucleate bodies which behave as pycnospores. Similar pycnospores were obtained by the author in cultures of *A. candidus* and *A. aureus*.

In connexion with the description of *C. serratus*, the following analogies with *Trichophyton* are pointed out: the mycelial ramifications bearing the aleuriospores mostly developed at right angles; the aleuriospores are lateral, solitary, sessile, or pedicellate, and readily detachable; there is a simultaneous development of external and internal aleuriospores by the same hypha; and there are intercalary or terminal, continuous or septate, clavate or fusiform swellings of certain portions of the mycelium. Similar evidences of relationship are stated to be available in the case of *Microsporon audouini*.

In artificial media the Gymnoascaceae were found to lose the faculty of producing ascigerous fructifications, or they developed various dissociated elements ordinarily found in connexion with the latter (involucrated, spiral, or pectinate hyphae) at random from the mycelium. Restored to their natural substrata (wings, fur, leather, bones, and the like), these Gymnoascaceae revert to the production of normal perithecia with asci and ascospores.

The author, therefore, concludes that the Dermatomycetes should be definitely placed in the family of the Gymnoascaceae, referring

to the subfamily Atelogymnoascaceae those genera in which ascigerous fructifications have not yet been observed, and to that of Gymnoascaceae those in which the perithecial stage is known. The confirmation of the relationship between the Dermatomycetes and the Gymnoascaceae strengthens the hypothesis of the probable saprophytic origin of the ringworm fungi. Inoculation experiments are planned to ascertain whether the saprophytic Gymnoascaceae are capable of developing in a virulent form in animals and of producing lesions similar to those caused by the common dermatomycoses.

The paper comprises sections dealing at length with the dissociation of the reproductive organs of the Gymnoascaceae and certain Hyphomycetes and other aspects of the morphology of the two families; and with the pleomorphism and systematic position of the Dermatomycetes. A bibliography of 66 titles is appended.

HUDE. **Sporotrichose primitive de la conjonctive avec localisation secondaire amygdalienne au cours du traitement.** [Primary sporotrichosis of the conjunctiva with secondary tonsillar localization in the course of treatment.]—*Bull. Soc. Ophtalm. Paris*, pp. 379–380, October, 1925. [Abs. in *Bull. Inst. Pasteur,* xxiv, 9, p. 401, 1926.]

Sporotrichum beurmanni [see this *Review*, iv, p. 283] was isolated from ulcerative lesions of the conjunctiva. A cure was effected with iodine.

BIGOT (A.) & VELU (H.). **Contribution à l'étude des blastomycoses animales.** [Contribution to the study of animal blastomycoses.]—*Rev. Path. Comp. et Hyg. Gén.*, xxv, 280, 281, & 282–3, 52 pp., 3 pl., 1925.

This paper, which summarizes present knowledge regarding epizootic lymphangitis of the horse and mule [*Cryptococcus farcinimosus*: see this *Review*, iv, p. 478] and lacrymal blastomycosis of the ass (*C. mirandei*) [ibid., iv, pp. 605, 606], is divided into three main sections dealing respectively with (1) the causal organisms; (2) the histology of the lesions; and (3) the pathogenic rôle of *Cryptococcus* and the associated bacteria in epizootic lymphangitis, and the connexions existing between human and animal blastomycoses.

The best culture media for the causal organisms were found to be broth, peptone water, and particularly Sabouraud's citric acid agar at a concentration of 5 per mille [not 5 per cent. as stated by error in this *Review*, iv, p. 605].

The examination of the tumour-like growths seen in lacrymal blastomycosis of the mule shows that they are inflammatory enlargements composed chiefly of lymphocytes and vascular cells. Giant cells do not occur and the growths are non-vascular.

The lesions, whether nodules of the skin, corded lymphatics, enlarged glands, or ulcerations of the respiratory mucous membranes, present a uniform histology, the invasion of the tissues by the parasite leading to the multiplication of the fixed and migratory connective tissue elements.

As a result of their observations and experiments in connexion with the vaccine therapy of epizootic lymphangitis, the authors conclude that staphylococci play no small part in the processes of infection, even converting benign into serious cases. In ten cases the use of staphylococcus vaccine in conjunction with pyotherapy gave markedly favourable results [see also this *Review*, v, p. 364].

URBAIN, BAROTTE, & CAPDEBIELLE. **Sur un cas de teigne équine due à l'Achorion gypseum.** [On a case of equine ringworm due to *Achorion gypseum*.]—*Bull. et Mém. Soc. Centr. Méd. Vétér.*, cii, p. 50, 1926. [Abs. in *Bull. Inst. Pasteur*, xxiv, 9, p. 397, 1926.]

The writers have supplemented the only two records hitherto known by a detailed account of a case of equine ringworm due to *Achorion gypseum* [see next abstract].

BROCQ-ROUSSEU. **Étude épidémiologique des teignes du cheval.** [Epidemiological study of the ringworm diseases of the horse.] —*Bull. Acad. Méd.*, Ser. 3, xcv, 10, pp. 242–243, 1926.

Of 36 isolations made by the writer from cases of equine ringworm in French cavalry horses [see this *Review*, i, p. 70], 31 belonged to *Microsporum equinum*, two to *Trichophyton equinum*, and one each to *T. verrucosum*, *T. gypseum asteroides*, and *Achorion gypseum* [see preceding abstract]. Of the 31 cases due to *M. equinum*, 26 occurred in animals of five years old or less, an age incidence corresponding to that of human subjects.

HART (HELEN). **Factors affecting the development of Flax rust, Melampsora lini (Pers.) Lev.**—*Phytopath.*, xvi, 3, pp. 185–205, 2 figs., 1926.

This is a more detailed account of the factors affecting the infection of fibre flaxes by rust (*Melampsora lini*) and the development of the parasite than that already noticed [see this *Review*, iv, p. 416]. The disease is stated to be particularly severe in the Red River Valley of North Dakota and in Minnesota, causing an average annual loss of nearly one per cent. of the crop.

The aecidiospores of the fungus begin to germinate after 45 minutes at optimum temperature and the uredospores after $1\frac{1}{2}$ hours. The viability of the latter may be retained for nearly three months at a temperature of 7° C. and a relative humidity of 60 per cent.

The germ-tubes of the uredospores were observed to enter the host through the stomata, forming an appressorium outside, and a substomatal vesicle below the stoma. In the case of the practically immune Argentine variety, some of the host cells, which seem extremely sensitive to the rust hyphae, are killed within a week after inoculation, and the fungus is unable to establish itself.

Light was found to be essential to the formation of uredosori after the establishment of the pathogen within the host. Increased light accelerates and decreased light retards their development. They may be formed at any temperature between 7° and 30° C. Severe infection occurs at 16° to 22°, and slight at 7° to 14° and 26° to 30°.

Plants supplied with phosphates were more severely rusted than those receiving nitrates or sulphates, in consequence of their luxuriant growth.

The fungus penetrates the cortical tissues of flax stems and often attacks the fibres. The hyphae have never been found to extend into the xylem.

THAYSEN (A. C.), BAKES (W. E.), & BUNKER (H. J.). **Studies on the bacterial decomposition of textile fibres. III. The occurrence of humus compounds in deteriorated fabrics and the bearing of their formation on the origin of peat and coal.**—*Biochem. Journ.*, xx, 1, pp. 210–216, 1926.

In connexion with the work of the Fabrics Co-ordinating Research Committee of the Department of Scientific and Industrial Research, England, an investigation was made into the microbiological aspect of peat formation.

It was ascertained by the examination of samples of bog peat plated out on wort agar that the number of fungi participating in the process of decomposition is negligible, bacteria and actinomycetes playing the chief part in the formation of peat. Observations further indicated that bacterial activity is greatest immediately below the surface of the vegetation, i. e., in the youngest layer. Broadly speaking, the action of micro-organisms in silage heaps is restricted to the first three or four weeks after construction, the climax being reached, according to Jones and Gibbard (*Abs. Bact.*, vii, p. 20, 1923) in 14 days. This is followed by a rapid decrease resulting in a complete cessation of activity two to three weeks later.

An examination was made of a sample of Egyptian linen cloth dating from the 18th dynasty which yielded what appeared to be a humic compound. It seems highly probable that this compound, which was almost insoluble in ether, was derived from the cellulose in the fabric, which was undyed and woven from pure linen fibres.

It was further shown that the humic compounds obtained from typical peats are of two different types, one yielding a chlorine derivative very similar to that of 'natural humus' (lignin humic compound), while the chlorine compound of the other is closely related to that of the artificial humus compounds derived either from the action of inorganic acids on carbohydrates or from cellulose fibres decayed through ageing.

WOOLF (D. G.). **'Rare earths' give mildew-proof and repellency.**—*Textile World*, lxix, 17, p. 27, 1926.

The so-called 'vivatex' process for rendering cotton fabrics mildew-proof and water-repellent is stated to be based on the use of thirteen rare earths of which the best known are thorium, cerium, didymium, and lanthanum. At the Pease Laboratories, Inc., New York, two samples of 'vivatex' olive drab were placed in standardized chambers at a temperature of 70° to 72° F., the humidity being maintained at a degree causing slight dampness of the cloth. Both samples were heavily inoculated with a mixed culture of mould spores isolated from mildewed samples from different localities in the middle Atlantic and eastern States. The results of the regular

examinations of these samples and the corresponding untreated controls indicated the complete immunity of the former from mildew over a period of $1\frac{1}{2}$ to 2 years.

Brooks (F. T.). **A disease of Tulips and Iris reticulata.**—*Gard. Chron.*, lxxix, 2050, pp. 271–272, 1926.

In addition to the disease of tulips known as 'fire' caused by *Botrytis tulipae*, which is of common occurrence in England, another sclerotial disease of tulips and *Iris reticulata*, caused by *Sclerotium* (*Rhizoctonia*) *tuliparum*, has recently come to the author's notice.

The symptoms in the two cases are almost identical and consist of either complete destruction of the plant below soil level or a dwarfed and malformed appearance of the shoots; affected bulbs practically never flower. White sclerotia (later in the season becoming brown to black), $\frac{1}{10}$ to $\frac{1}{8}$ inch in diameter, are embedded in the neck of the bulb and the part of the shoot below the soil level. In the case of *S. tuliparum* no spore stage is known and infection occurs primarily through the soil, in which the sclerotia may remain alive for at least three years. In the disease caused by *B. tulipae*, however, infection is often caused by sclerotia which are already present on or within the bulb scales, while in the leaf blight stage the disease is commonly spread by spores.

This is believed to be the first record of *S. tuliparum* on *I. reticulata*, although it has previously been found on *I. hispanica*, hyacinths, daffodils, *Scilla sibirica*, *Fritillaria imperialis*, and tulips.

Pape (H.). **Der Vermehrungspilz an Cyklamen-Sämlingen.** [The propagation fungus on Cyclamen seedlings.]—*Gartenwelt*, xxx, 16, pp. 248–250, 3 figs., 1926.

Towards the end of 1925 the writer examined some diseased cyclamen seedlings which showed dark brown, sunken areas of variable dimensions on the side or base of the corm, sometimes accompanied by decay of the roots, or discoloration and wilting of the base of the petiole and the starting-point of the second leaf. In severe cases all these parts were affected. The plants were found to be infected by the so-called 'propagation fungus', *Moniliopsis aderholdi*. Once the disease has developed the affected seedlings can scarcely be saved, but infection may be largely prevented by adequate ventilation and plenty of light in greenhouses and frames, wide planting, and thorough sanitation of beds and frames. The walls of water tanks should be painted with 2 per cent. copper sulphate, Bordeaux mixture, or milk of lime, while the woodwork of frames and the like should be scrubbed, sprayed with formalin (1 in 200), and painted as above.

Zöppig (F.). **Nochmals: Cyklamen-Schädlinge und ihre Bekämpfung.** [Further observations on Cyclamen pests and their control.]—*Gartenwelt*, xxx, 16, pp. 250–251, 1926.

Notes are given on the following fungous diseases of cyclamen. Root rot (*Thielavia basicola*), which frequently occurs in beech leaf soils and may be controlled by aeration, sparing use of water and manure, and the addition of sand and lime to the soil. Similar

measures are applicable also to *Botrytis*, which causes a corm rot and destroys immature blossoms. *Septoria cyclaminis* forms red (later grey), concentric spots on leaves and stems. These comparatively insignificant blemishes, like those caused by a species of *Phoma* that is sometimes found as a cyclamen parasite, may be controlled by the removal and destruction of infected material.

FISCHER (R.). **Gloeosporium minutum, ein seltener Schädling der Anthurium-Kulturen.** [*Gloeosporium minutum*, a rare parasite of the cultivated *Anthurium*.]—*Gartenzeit. der österr. Gartenbaugesellsch. in Wien*, lvii, p. 42, 1925. [Abs. in *Neuheiten auf dem Geb. des Pflanzensch. 1926*, Mitt. ii, p. 41, 1926.]

This is a record of the occurrence in the hot-houses in Schönbrunn [Austria] of *Gloeosporium minutum* on the leaves of *Anthurium scherzerianum*, on which it forms circular, frequently coalescing, brown spots up to 2 cm. in diameter, with a brownish-yellow margin. The spots are usually situated between the veins of the leaves, and the attacked tissues may dry up and fall out. The spores of the fungus are very small and develop under the epidermis. Although effective control measures have still to be tested, it is believed that outbreaks of the disease might be prevented by spraying the plants with copper or sulphur preparations.

WORONICHIN (N. N.). **Exobasidium caucasicum Woronich. in Transcaucasia and Kamchatka.**—*Phytopath.*, xvi, 4, pp. 293–297, 1926.

A comparison of herbarium material of *Exobasidium caucasicum* Woronich. and *E. pentasporium* Shirai revealed certain differential characters which clearly distinguish the two species. The hymenium of *E. caucasicum* is uniformly dispersed on the lower surface of the young leaves, while that of *E. pentasporium* generally occurs in patches. The basidiospores of *E. caucasicum* number four (occasionally two or three) and those of *E. pentasporium* four to six (generally five). *E. caucasicum* forms witches' brooms on the branches of its hosts, a feature which is absent in the case of infection by *E. pentasporium*. Finally, the hosts of *E. caucasicum* belong to the section *Eurhododendron* and those of *E. pentasporium* are *Azalea* and *Tsusia*.

The discovery of *E. caucasicum* on *Rhododendron chrysanthum* in Kamchatka is regarded as having an important bearing on the migration of the genus *Rhododendron*, a discussion of which forms the basis of the paper.

SMITH (C. O.). **Similarity of bacterial diseases of Avocado, Lilac, and Citrus in California.**—*Phytopath.*, xvi, 3, pp. 235–236, 1926.

During the spring of 1925 a new bacterial blemish on the fruit of Guatemalan avocados [*Persea gratissima*] and a bacterial disease of lilac were investigated. Both conditions appear to be due to *Pseudomonas citriputeale*, the causal organism of citrus blast and black pit [see this *Review*, v, p. 358]. On the avocado the spots are brownish to black, firm, irregular to circular, measuring 2 to

10 mm. or more, and limited to the rind. The lenticels are the channels of infection. The circular spots on lilac leaves measure 2 to 5 mm., and definite lesions are formed on the stems. The organisms isolated from both hosts are undergoing investigation and comparison with *Ps. syringae,* the cause of a similar lilac disease in Europe. Preliminary results indicate that citrus blast, avocado blemish, and the lilac disease are closely related and probably due to the same organism.

WEBER (ANNA). **Sprøjtning af Frugttraeer og Frugtbuske mod Snyltesvampe samt disses Biologi.** [Spraying of fruit trees and bushes against parasitic fungi, together with the biology of the latter.]—*Tidsskr. for Planteavl,* xxxii, 2, pp. 219–318, 1 fig., 1 graph, 1926.

The results of the spraying experiments for the control of the parasitic fungi of fruit trees, carried out by the Danish Phytopathological Service since 1916, are very fully described and the data presented in tabular form. Good control of apple scab (*Venturia inaequalis*), the perithecial stage of which occurs on overwintered leaves, was obtained by the application of 1 per cent. Bordeaux mixture or 1 in 40 lime-sulphur. It may, however, sometimes be necessary to reduce the strength of these mixtures in order to avoid injury to the foliage, especially in damp seasons. In such cases the use of 0·5 per cent. Bordeaux mixture, 1 in 60 lime-sulphur, or the so-called 'white' Bordeaux mixture (0·8–2·4–100) is recommended. Where only one application is to be given, it should be made immediately the petals fall or a fortnight later. A safer plan, however, is to spray once before flowering and to give several applications later.

Pear scab (*V. pirina*), which also occurs in the perithecial stage on overwintered leaves, chiefly attacks the pedicels, fruits, and twigs. The disease was best controlled in the two experiments of this series by 0·5 or 1 per cent. Bordeaux mixture or white Bordeaux mixture. The higher concentrations of Bordeaux mixture caused some injury both to foliage and fruit, while 2 per cent. éclair (a French dust designed to replace Bordeaux mixture) caused serious damage. This injurious effect (which was also observed on sprayed apples) may be reduced by the addition of 2 per cent. lime. The addition of harpix soap [see this *Review,* iii, p. 507] increased the adhesiveness of Bordeaux mixture and lime-sulphur.

Brown rot of stone fruits (*Sclerotinia cinerea*) frequently causes heavy damage to the flowers and twigs of *Prunus cerasus, P. pseudocerasus,* and *P. triloba,* and to the fruits of sweet cherries and plums. The apothecial stage has not been found in Denmark. Two applications of 1 per cent. Bordeaux mixture after blossoming failed to prevent infection, the second (a fortnight after petal fall) scorching the leaves and pedicels. *S. fructigena* is prevalent on apples and pears, causing a destructive rot of flowers and twigs in damp seasons. Up to 60 per cent. of ripening pears may be affected. The apothecial stage has been found on 1½ year old apples. Among the most susceptible apple varieties are Alexander, Cellini, Cox's Pomona, Charlamowsky, Red and White Astrakhan, Keswick Codlin,

and Signe Tillisch; the pears chiefly infected include Amanlis, Bonne Louise, Clapp's Favourite, and Flemish Beauty.

Leaf curl of peach (*Taphrina deformans*) may be controlled by the timely application (before the buds begin to swell) of 1 in 25 lime-sulphur.

The best control of gooseberry mildew (*Sphaerotheca mors-uvae*) was given by one application of 4 per cent. copper sulphate or 1 in 9 lime-sulphur, shortly before the buds open, and two or more applications of 1 in 30 or 1 in 35 lime-sulphur (not on yellow varieties) during the summer. Good results were also given by dormant applications of 2 or 2·6 per cent. formalin, 7 or 7·5 per cent. carbokrimp (Utrechtsche Asfaltfabrik, Utrecht, Holland), 25 per cent. defensolat (Phyllaterion Co., Trelleborg, Denmark), 5 per cent. karbolineum emulsion, and 5 per cent. gargoyle spraying oil (Vacuum Oil Co.). For summer applications 0·5 per cent. formalin or 0·4 per cent. sodium lye (four times after picking) reduced infection considerably and caused no damage.

Vine mildew (*Uncinula necator*), which is stated to be extremely destructive in the greenhouse, may be controlled by the application (between December and March) of 1 in 9 lime-sulphur. Stripping off the bark appears to have increased the efficacy of the spray in two cases.

A bibliography of 123 titles is appended.

RUGGLES (A. G.) & PETERSON (P. D.). **Spray program for Minnesota.**—*Minnesota Horticulturist*, liv, 4, p. 117, 1926.

The following spray schedule is recommended. A. Apples. (1) Pink stage: powdered lead arsenate, 1½ lb.; liquid commercial lime-sulphur, 5 qts., or dry lime-sulphur, 4 lb.; water, 50 galls. (2) Petal fall and (3) last week of June or early July: same as (1). This treatment aims at the control of scab [*Venturia inaequalis*] and insect pests.

B. Plums. (1) Just before blossoms open, (2) just after petals fall, (3) when fruit is the size of small peas, and (4) when colour begins to show: same as for apples. The first spray is for the control of plum pockets [*Taphrina pruni*] and blossom and twig blight [*Sclerotinia cinerea*], and the remainder for brown rot [*S. cinerea*].

BAGENAL (N. B.), GOODWIN (W.), SALMON (E. S.), & WARE (W. M.). **The control of Apple scab.**—*Journ. Min. Agric.*, xxxiii, 1, pp. 38–49, 1 fig., 1926.

This is a detailed account of the spraying experiments against apple scab [*Venturia inaequalis*] made in 1925 in continuation of the authors' previous work [see this *Review*, iv, p. 611]. In this new series, the plots were arranged so that groups of trees received respectively either two or three applications of Bordeaux mixture or of lime-sulphur, while one group was sprayed three times with lime-sulphur plus lead arsenate. The results showed definitely that three applications of a fungicide are necessary to control the disease effectively in the Bismarck variety, and that of these the early spraying at the 'pink bud' stage is particularly important The most complete control was obtained with three applications of

Bordeaux mixture, the next best results being obtained with lime-sulphur plus lead arsenate. The beneficial effects of the additional early spraying was shown in the substantial increase of apples free from scab over that obtained with only two applications. Serious leaf fall was occasioned late in the season by the use of Bordeaux mixture, but no harmful effect on the season's crop from these trees was observed. There was no evidence in 1925 that any of the spray applications caused a dropping of the young fruit.

GRUBB (N. H.) & HATTON (R. G.). **Post-blossoming use of lime-sulphur spray, and fruit-dropping.**—*Gard. Chron.*, lxxix, 2053, pp. 324–325, 1926.

The authors consider that the evidence contained in a recent paper by Bagenal, Goodwin, Salmon, and Ware [see above abstract] does not substantiate their claim that no abnormal dropping of young fruit was caused by spraying the apple trees after the petals fall with lime-sulphur of the normal concentration. They still adhere to their view [see this *Review*, iv, p. 99] that the post-blossoming use of this preparation entails a considerable risk of reducing the crop.

JØRSTAD (I.). **Epleskurven. (Fusicladium dendriticum = Venturia inaequalis).** [Apple scab. (*Fusicladium dendriticum* = *Venturia inaequalis*).]—*Norsk Havetidende*, xlii, 5, pp. 52–55; 6, pp. 69–72, 2 figs., 1926.

The symptoms of apple scab (*Venturia inaequalis*) are described and its occurrence in Norway considered in relation to meteorological conditions. The disease is most prevalent in the coastal districts on the Signe Tillisch, Gravenstein, Torstein, and Astrakhan varieties. Good control may be obtained by three applications of lime-sulphur (just before and immediately after blossoming, and once during the summer, respectively). Bordeaux mixture, though also effective, is liable to cause considerable damage to the foliage and fruit.

ROBERTS (J. W.) & PIERCE (L.). **Apple blotch.**—*U.S. Dept. of Agric. Farmers' Bull.* 1479, 11 pp., 9 figs., 1926.

A popular account is given of the economic importance, distribution, symptoms, and life-history of the causal organism of apple blotch (*Phyllosticta solitaria*) [see this *Review*, iv, p. 743]. The relative susceptibility to the disease of some well-known varieties is shown, and directions are given for control by Bordeaux mixture or dilute lime-sulphur. The following general spray schedule is recommended for the control of blotch and other fungous diseases of apples. (1) Directly after blossom cluster buds open: dilute lime-sulphur ($1\frac{1}{2}$ galls. lime-sulphur at 33° Baumé per 50 galls. water). (2) Immediately petals fall: same as (1). (3) A fortnight after petals fall: Bordeaux mixture 3–4–50. (4) Two or three weeks later: same as (3). (5) Two or three weeks after (4): Bordeaux mixture 4–4–50. (6) Two or three weeks after (5): same as (5).

McClelland (N.) & Tiller (L. W.). **Cool storage investigations in New Zealand. Season 1925.**—*Fruit World of Australasia*, xxvii, 4, pp. 179–184, 1926.

In this paper, taken from a recent bulletin of the Cawthron Institute, Nelson, New Zealand, the authors give a brief survey of the work of other investigators on flesh collapse of stored apples, and of their own earlier observations [see this *Review*, iv, p. 549; v, p. 372], followed by a description of experiments carried out at a recently constructed experimental cold store at the Nelson Freezing Company's stores, Stoke, in 1925. The store was of the dry battery, forced air circulation type, and was independently controlled. The flesh temperature of the apples was maintained between 32° and 34° F. and the humidity of the air entering the chamber was about 50 per cent.

The results obtained confirmed the previous indications that low temperature increases internal breakdown, but that the damage is reduced when the humidity is also kept low.

A temperature high enough to eliminate internal breakdown (about 46° F.) is not practicable commercially, but it is considered probable that at about 38° to 40°, with a reasonably low humidity, the amount of loss can be reduced to a minimum. A low temperature, however, is essential for the satisfactory storage of pears, with which a flesh temperature of 32° has given excellent results.

The influence of maturity on the development of internal breakdown was more marked than in 1924, probably on account of seasonal variations, especially the greater amount of rain during the latter part of the ripening period. In the experimental store, with Sturmer apples, the amount of internal breakdown increased with the degree of maturity of the fruit, but the loss by shrivelling or wilting was greatest in the least mature fruit. Stored pears are also influenced by the stage at which they are picked; excessively green pears shrivel badly and are tasteless, while over-ripe fruit does not stand lengthy storage.

The experimental data have definitely shown that locality may have a determining effect on the prevalence of the disease in apples even in bad seasons.

As in previous experiments the beneficial effect of delayed storage was noticeable in the case of Jonathan apples. The total incidence of the disease in mature fruit kept out of store for five weeks was on 18th August only 12 per cent. as compared with 22 per cent. in that stored immediately after picking on 18th March. With Sturmers, however, delayed storage increased breakdown.

Roberts (J. W.) & Dunegan (J. C.). **Blossom blight of the Peach.**—*Phytopath.*, xvi, 3, pp. 217–222, 1926.

The results of inoculation experiments carried out at Washington, D.C., and Fort Valley, Georgia, in 1924 and 1925, show that the conidia and ascospores of *Sclerotinia cinerea* are capable of causing a blossom blight of the peach. All parts of the open blossoms may be attacked, direct infections of the stigmas, anthers, petals, and inner surfaces of the sepals having been observed. At a moderate temperature (25° C.), under conditions of extreme moisture, only a few days are required for the development of the disease. It is con-

cluded that either ascospores or conidia, or both, may be responsible for outbreaks of blossom blight in peach orchards.

HORNE (W. J.), WELDON (G. P.), & BABCOCK (E. B.). **Resistance of Peach hybrids to an obscure disease in Southern California.**—*Journ. of Heredity*, xvii, 3, pp. 99–104, 4 figs., 1926.

Specimens of some 30 peach hybrids were tested at Riverside, California, in 1924 for resistance to an obscure disease, involving delayed blossoming and foliation as well as a reduction of yield, which was first observed in the low-lying southern regions of the State in 1904. In nearly all the hybrids one of the parents was of the resistant South China type known as Peento or Saucer peach. The latter part of 1923 and early months of 1924 were characterized by marked fluctuations in the weather conditions, and it was observed that heat and intense sunlight predisposed the trees to this disease, which was also observed in a milder form on other fruit trees. Individuals shaded for the whole or part of the day were practically normal in time of blossoming and foliation. Early flowering and leafing varieties were found to be less affected than late ones.

The information collected in 1924 (when a special conference of horticulturists and phytopathologists met to discuss the peach situation) suggests that the cause of the trouble is to be traced to the high temperature and intense sunlight, with low humidity, of February, and indicates the general superiority of the hybrid derivatives of South China races over north-eastern commercial types, with a few exceptions [which are enumerated].

The first-named author's observations denote that the disease under discussion is not peculiar to California. In 1905 similar symptoms were noticed in peach trees near Havana, Cuba, and here also the South China varieties were comparatively resistant. One of these, Red Ceylon, was widely distributed in Cuba and gave considerable promise of success.

BERKELEY (G. H.) & JACKSON (A. B.). **Verticillium wilt of the Red Raspberry.**—*Scient. Agric.*, vi, 8, pp. 261–270, 8 figs., 1 graph, 1926.

The wilt disease of cultivated red raspberries, formerly termed blue stem, is stated to be widespread and apparently increasing in Ontario [see this *Review*, iii, p. 725], where it is the cause of considerable financial losses.

Isolations from diseased canes gave a species of *Verticillium* which was proved by inoculations of healthy plants with pure cultures to be able to cause the characteristic symptoms of the disease. The blue discoloration, to which the earlier name of the disease refers, may be lacking, but yellowing, wilting, and dropping of the leaves are invariably found, so that the term 'wilt' is regarded as more appropriate. These symptoms begin in the lower leaves and spread upwards, a tuft of small brownish leaves being often left at the top of the cane. Later in the year many of the canes die, but new shoots usually arise from the underground roots. Eventually the whole plant may be killed.

Although the raspberry *Verticillium* produces micro-sclerotia in

abundance and is therefore related to *V. dahliae* [see this *Review*, iv, p. 495], the authors' comparative cultural studies have satisfied them that it is a distinct species. Cultures of the raspberry species show sclerotia first on nitrate dextrose agar, whereas *V. dahliae* forms sclerotia first on potato dextrose. The mycelium of the former is white, thin, and loose in texture, whereas that of the latter is dense, compact, and greyish-white; both become eventually covered with a sclerotial crust, on which, in the raspberry fungus, tufts of white mycelium occur. The conidiophores of the raspberry fungus are 20 to 400 μ and the ovate to globoid conidia measure 2·75 to 6·25 by 1·25 to 4·25 μ, whereas the conidiophores of *V. dahliae* are shorter and the conidia oblong to almost cylindrical and 3 to 7 by 1·5 to 3 μ.

The red raspberry fungus is also regarded as distinct from *V. caulophagum* (*Acrostalagmus caulophagus* Lawrence), the cause of 'blue stem' of black raspberries in the State of Washington, since the production of micro-sclerotia has not been recorded in the latter and the black colour of its cultures is stated to be due to strands of chlamydospores and to dark coloured mycelial branches. The authors have therefore named their fungus *V. ovatum* n. sp., an English diagnosis of which is given.

Suggestions for control include the use of certified healthy stock for planting and the avoidance of soil in which other plants suspected of being susceptible to this disease have been grown and have shown signs of wilt. Potatoes, tomatoes, eggplants, and chilli pepper are said to be liable to increase the amount of wilt in a succeeding raspberry planting.

RUGGLES (A. G.) & WINTER (J. D.). **Some aspects of mosaic of the Red Raspberry from the standpoint of the nursery inspector.**—*Minnesota Horticulturist*, liv, 3, pp. 79–85, 1926.

The results obtained in the control of mosaic of red raspberries by two years' nursery inspection in Minnesota are stated to be extremely encouraging. Special attention has been paid to the very profitable Latham variety [see this *Review*, iv, p. 357]. In 1925 32 out of 33 Latham plantings rogued in 1924 were found to be reasonably free from disease. The results of an inspection of 67 plantings in various parts of the State show that of 112,110 Latham plants from isolated plots only 1,465 (1·3 per cent.) were infected, while 4,851 (9 per cent.) of the 53,900 plants growing in proximity to diseased plots showed symptoms of mosaic. These figures clearly indicate the importance of isolation in the successful control of mosaic, and nursery growers are now required to keep their plots of commercial raspberries not less than 20 rods from diseased plantings. From the data compiled as the result of the inspection, however, it would appear that the transmission of the disease by the use of infected cuttings is of greater importance than secondary infection.

ULRICH (F.). **Spraying Raspberries.**—*Minnesota Horticulturist*, liv, 4, pp. 113–115, 1926.

The writer has obtained very satisfactory results in the control of raspberry anthracnose (*Plectodiscella veneta*) by the application,

with the D. & B. sprayer (Dobbins Mfg. Co., North St. Paul), of 5–5–50 Bordeaux mixture plus $1\frac{1}{2}$ lb. lead arsenate. The treatment is carried out when the young shoots are six to eight inches in height.

ROSE (D. H.). **Relation of Strawberry fruit rots to weather conditions in the field.**—*Phytopath.*, xvi, 3, pp. 229–232, 1 graph, 1926.

The results of a field study, made at Beebe, Arkansas, in 1923 and 1924, on the correlation between weather conditions and the incidence of leather rot (*Phytophthora cactorum*) [see this *Review*, iv, p. 100] and other rots of strawberries indicate that rainfall and temperature are decisive factors in the development of these diseases, which develop with severity when a rainy period during the picking season is followed by warm weather, whereas if the rains are followed by cool weather, there is less danger of rot.

STEVENS (N. E.) & SAWYER (W. H.). **The distribution of Cranberry false blossom.**—*Phytopath.*, xvi, 3, pp. 223–227, 1926.

In this paper additional information is presented on the distribution of the false blossom disease of cranberries (*Vaccinium macrocarpon*) [see this *Review*, iv, p. 490]. In 1925, 48 out of 61 cultivated bogs in Wisconsin were found to be infected, while in the Cape Cod region of Massachusetts the disease is known to occur on 52 bogs. False blossom is believed to have spread from Wisconsin, the original seat of the disease in the United States, to New England and the Pacific Coast. In Oregon practically every bog is stated to be infected, while in New Jersey it is also very widely distributed, though not destructive in many cases. The McFarlin variety appears to be highly resistant to false blossom both in Massachusetts and Wisconsin, and its cultivation in badly diseased areas, together with regular spring and autumn flooding, is recommended as a promising control measure.

DEMAREE (J. B.). **Little leaf disease of Pecans.**—*Phytopath.*, xvi, 4, pp. 277–283, 2 figs., 1926.

A description is given of a disease affecting the leaves and twigs of pecan [*Carya pecan*] trees, first observed at Ocean Springs, Missouri, in 1920, and since reported to occur in various localities of Georgia, Florida, and Alabama. The condition, which has been termed 'little leaf', appears to be restricted to urban areas. Affected leaves are generally composed of a reduced number of leaflets, averaging about eight instead of 11 to 15 to the leaf. The diseased leaflets are oblong or rounded, often with obtuse or notched apices, instead of falcate, oblong-lanceolate, or serrate, and they are frequently much reduced in size. Affected twigs are slender and feeble, with small, blunt buds.

Negative results were given by experiments in the transmission of infection by budding and grafting. A badly diseased tree transplanted to an environment approximating to field conditions recovered entirely.

TRAPPMANN (W.). **Methoden zur Prüfung von Pflanzenschutzmitteln. I. Benetzungsfähigkeit.** [Methods of testing plant protectives. I. Wetting capacity.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xiv, 3, pp. 259–266, 1 fig., 1926.

The moistening of a solid surface by a liquid depends on the surface tension of the liquid, the surface tension of the solid, and the tension of the interfacial surface, but the first-named factor is the most important and the one on which the wetting capacity primarily depends.

To estimate the surface tension of a spray fluid, a pipette with a graduated bulb was fitted with a short capillary at the lower end. A horizontal capillary was inserted between the bulb and the terminal capillary in another type of apparatus. The greater the number of drops of a liquid that will pass through such a pipette, the lower the surface tension of the liquid. The number of drops from a known volume of liquid at a given temperature thus gave an accurate measure of the wetting capacity. Soap solutions of 0·012 to 5 per cent. were used with distilled water, tap water, and distilled water with 0·1 per cent. calcium chloride, and the results plainly showed the low wetting power obtained with a high lime content.

Compared with gelatine, peptone, 'Schering 15170' (Chemische Fabrik auf Aktien, Berlin N 39), and casein or milk, soap was found to be the best and cheapest wetting material. It cannot, however, be mixed with arsenic compounds and milk was found to be an efficient substitute in such cases. 'Schering 15170' is especially suitable for use in spraying delicate greenhouse plants.

GOODWIN (W.), MARTIN (H.), & SALMON (E. S.). **Fungicidal properties of certain spray-fluids, IV.**—*Journ. Agric. Science*, xvi, 2, pp. 302–317, 1926.

In continuation of their investigations on sprays [see this *Review*, v, p. 116], the authors studied the fungicidal value of certain spray fluids as tested by their action on the conidial stage of hop mildew (*Sphaerotheca humuli*) on young leaves of hops grown in the greenhouse. Two series of spraying experiments were made, (*a*) with solutions containing polysulphide sulphur, (*b*) with solutions containing arsenic acid.

The results of tests of a commercial liver of sulphur preparation, containing 9·28 per cent. monosulphide sulphur, 27·56 per cent. polysulphide sulphur, 8·56 per cent. thiosulphate, and 2·01 per cent. sulphate, showed that, under the conditions of the experiments, a solution containing 0·092 per cent. potassium polysulphide was fungicidal while a solution containing 0·066 per cent. proved almost but not completely effective. With a commercial sodium polysulphide preparation called 'sulfluid', containing 1·57 per cent. monosulphide sulphur, 7·05 per cent. polysulphide sulphur, 0·41 per cent. thiosulphate, and 0·73 per cent. sulphur, a solution containing 0·12 per cent. sodium polysulphide was fungicidal and 0·03 per cent. was ineffective. It seems probable that solutions of sodium and potassium polysulphides possess the same fungicidal values, being effective at about 0·1 per cent. Similar tests with commercial lime-

sulphur showed that a solution of 0·078 per cent. calcium polysulphide was just below fungicidal strength, which is in agreement with the previous results indicating that 0·11 per cent. is the lethal dose [see this *Review*, ii, p. 169].

The arsenate tests showed that lead arsenate containing 0·204 per cent. As_2O_5 was fungicidal; 0·1 per cent. appears to be just below fungicidal strength. Lead thioarsenate and dicalcium arsenate, each containing 0·05 per cent. As_2O_5, and disodium arsenate at a strength of 0·0238 per cent. As_2O_5 all proved fungicidal without causing injury to the leaf tissue.

Solutions of calcium polysulphide and of lead arsenate at concentrations below fungicidal strength proved to be fungicidal when mixed together.

Bailey (E. M.). **Report on commercial insecticides and fungicides 1925.**—*Connecticut Agric. Exper. Stat. Bull.* 272, pp. 143–150, 1925. [Received April, 1926.]

In addition to a number of preparations used exclusively for insecticidal purposes, the following were analysed during 1925. A. Bordeaux-lead arsenate mixtures, including (1) pyrox (Bowker Chem. Co., New York), a paste containing 5·57 per cent. arsenic oxide, 8·39 per cent. copper oxide, and 1·28 per cent. lead oxide. (2) Bordo-lead dust (Chipman Chem. and Engin. Co., New York), containing 8·73 per cent. As_2O_5, 20·62 per cent. CuO, and 15·24 per cent. PbO. (3) Bordo-arsenate dust (Glidden Co., Cleveland, Ohio), containing 14·77 per cent. As_2O_5, 16·66 per cent. CuO, and 26·64 per cent. PbO. (4) Hexpo dust (H. J. Smith Co., Utica, N.Y.), containing 8·37 per cent. As_2O_5, 22·62 per cent. CuO, and 18·89 per cent. PbO. (5) Bordo-lead mixture, a paste containing 8·91 per cent. As_2O_5, 3·22 per cent. CuO, and 18·32 per cent. PbO.

B. Sulphur preparations, comprising (1) sulfocide (B. S. Pratt Co., N.Y.), containing 33·78 per cent. total sulphur. (2) Niagara pomodust (Niagara Sprayer Co., Middleport, N.Y.), containing 89·73 per cent. total sulphur, and 1·84 per cent. metallic arsenic. (3) Sulphur-arsenate dusts 90–10 and 85–15 (John Bacon, Gosport, N.Y.), containing, respectively, 88·27 and 84·75 per cent. total sulphur and 2·85 and 3·74 per cent. As_2O_5. (4) Lime-sulphur (Blanchard's and Grasselli's), containing, respectively, 19·62 and 26·35 per cent. total sulphur, the specific gravity of the former at 22° C. being 1·2333 and that of the latter 1·3080.

The constituents of a sample of kayso (Golden State Sales Corp., N.Y.) analysed as follows: 3·30 per cent. nitrogen, 21·05 per cent. casein, and 44·32 per cent. lime.

Britton (W. E.) & Clinton (G. P.). **Spray bulletin.**—*Connecticut Agric. Exper. Stat. Bull.* 271, pp. 93–140, 93 figs., 1 diag., 1926.

Full directions are given for the control of fungous diseases and insect pests of the cultivated plants of Connecticut, which are listed in alphabetical order. The bulletin further contains instructions for the preparation of insecticides and fungicides; brief popular notes on the life-history of insects and fungi; and a list of manufacturers and dealers in spraying apparatus and supplies.

BECKER (A.). **Ueber den Einfluss der Samenbehandlung mit Reizchemikalien auf die Keimung.** [The influence on germination of seed treatment with chemical stimulants.]—*Landw. Jahrb.*, lxiii, 4, pp. 501–553, 9 figs., 1926.

This is a comprehensive account of a series of experiments carried out at the Bonn-Poppelsdorf Agricultural College on the stimulation of germination in a number of agricultural plants by chemical treatment [see this *Review*, v, p. 291]. As already stated, the apparent stimulus to germination given by certain preparations is considered to be really the result of a fungicidal action of the disinfectants, which enables the treated plants to make normal growth and thus to produce a yield superior to that from the untreated seed. In no case was there any increase of yield which could be definitely attributed to seed stimulation as distinct from disinfection. A bibliography of 79 titles is appended.

CHAPMAN (A. C.). **The President's address: the Fungi Imperfecti, and a further plea for an institute of industrial microbiology.**—*Journ. Roy. Microscop. Soc.*, Ser. II, xlvi, 1, pp. 1–16, 1926.

In this address, read before a meeting of the Royal Microscopical Society, England, on 20th January, 1926, an account is given of the industrial importance of various fungi of uncertain systematic position usually included in the genera *Torula*, *Mycoderma*, *Monilia*, *Chalara*, *Endomyces*, and *Oidium* of the Fungi Imperfecti. Attention is called to the action of members of the genus *Torula* in the conditioning of beer and, associated with bacteria, in the preparation of the fermented milk beverages, kephir, koumiss, &c.; the damage caused by the presence of *Mycoderma* in beer or wine; the fat-forming fungus (*Endomyces*) [*vernalis*: see this *Review*, iv, p. 113], and the like. In conclusion a plea is made for the foundation of a National Institution of Industrial Microbiology for the study of these and other industrially important micro-organisms.

ANDERSON (P. J.), HASKELL (R. J.), MUENSCHER (W. C.), WELD (CLARA J.), WOOD (JESSIE I.), & MARTIN (G. H.). **Check list of diseases of economic plants in the United States.**—*U.S. Dept. of Agric. Bull.* 1366, 111 pp., 4 maps, 1926.

This list of the diseases of economic plants in the United States, which has been prepared from data assembled by the Office of Plant Disease Survey and Pathological Collections, is believed to represent the first attempt at such an enumeration in the country. The scientific and common names of the hosts and parasites are given, with their distribution by States, and the paper also includes notes on the basis and scope of the list and the system of nomenclature adopted for the hosts and pathogens.

Calendario de patología vegetal y zoología económica. II. Enfermedades de origen vegetal, etc. [Calendar of plant pathology and economic zoology. II. Diseases of vegetable origin, &c.]—*Min. Agric. Nac. (Buenos Aires) Secc. Prop. e Inform. Circ.* 601, pp. 24–48, 36 figs., 1926.

The chief fungous, bacterial, and physiological diseases of agri-

cultural and horticultural crops in the Argentine Republic are briefly described, with directions for control.

MORSTATT (H.). **Bibliographie der Pflanzenschutzliteratur: das Jahr 1925.** [Bibliography of plant protection literature published in 1925.]—*Biol. Reichsanst. für Land- und Forstwirtsch.*, Berlin-Dahlem, 228 pp., 1926.

This volume, comprising a bibliography of the German and foreign literature published in 1925 on various aspects of plant protection, has been prepared on the lines followed in previous years [see this *Review*, iv, p. 626].

CARBONE (D.). **L'immunità nelle piante.** [Immunity in plants.]—*Riv. di Biol.*, viii, 1, pp. 62–73, 1926.

This is a review of the current literature on the phenomenon of immunity in plants. The work of the various authors cited is briefly summarized and a bibliography of 32 titles is appended.

JONES (L. R.). **Securing disease resistant plants: how important is it? whose job is it?**—*Science*, N.S., lxiii, 1631, pp. 341–345, 1926.

After a brief general discussion of the development of phytopathology in the United States, the writer indicates the functions of (1) plant pathologists, (2) plant geneticists, and (3) plant culturists in the supremely important work of securing disease-resistant plants. In this work, plant pathologists are primarily concerned in the study of the nature and cause of resistance, and in its relations to environment and the like; in the estimation, by observation and experiment, of the relative merits of recognized varieties as to resistance; and, to a lesser extent, in the search for resistant individuals and the perfecting of resistant strains by hybridization. The scope of the activities of geneticists and culturists is also defined, and a section, illustrated by a few striking examples, is devoted to the share of amateurs and commercial men in the discovery of disease-resistant varieties of plants.

VAN THIEL (P. H.). **Was ist Rickettsia melophagi?** [What is *Rickettsia melophagi*?]—*Arch. für Protistenkunde*, lii, 3, pp. 394–403, 1 fig., 1925.

In connexion with Woodcock's conclusion that the Rickettsiae are derived from the degenerating bodies of flagellates [see this *Review*, iv, p. 690], the author describes his recent observations at the Leiden (Holland) Institute of Tropical Medicine.

It was shown that the metachromatic corpuscles of the crithidia, such as those found in the sheep ked, *Melophagus ovinus*, are identical with Meyer's volutin corpuscles (*Bot. Zeit.*, lxii, p. 113, 1904), giving a positive reaction to methylene blue and 1 per cent. sulphuric acid. Rickettsiae, on the other hand, fail to react to this stain, nor are they soluble, like the metachromatic granules in the crithidia, in a 5 per cent. solution of sodium carbonate, nor in the process of hydrolysis with hydrochloric acid. Rickettsiae and the volutin corpuscles further differ in shape, the former being

uniformly oval and the latter spherical and of very variable dimensions [see also this *Review*, iv, p. 689].

Woodcock's theory as to the derivation of the metachromatic corpuscles may be partially correct, but the identification of these bodies with those of *Rickettsia* is, in the author's opinion, erroneous.

The crithidia are stated to remain alive in the interior of the sheep ked some days after the death of the insects, whereupon degeneration commences. In one of the three forms of degeneration observed, the similarity between *Rickettsia melophagi* and the metachromatic granules is extreme, but this is no proof of identity.

PRAT (H.). **Études des mycorhizes du 'Taxus baccata.'** [Studies of the mycorrhiza of *Taxus baccata*.]—*Ann. Sci. Nat. Bot.*, Sér. X, viii, 1–2, pp. 141–163, 15 figs., 1926.

After a brief review of the work of previous investigators on endotrophic mycorrhiza [see this *Review*, iv, p. 755], the author records his observations at some length on the mycorrhiza of the common yew (*Taxus baccata*).

The endophyte agrees in its main features with that referred to by Gallaud as the *Paris quadrifolia* type, which has already been recorded on various Gymnosperms. It is characterized by branched, haustorium-like arbuscles restricted to the cells in which they are originally produced, and multinucleate vesicles (up to 40 μ in diameter) which are abundant in certain parts of the root, and may be either intercalary or on isolated stalks. The mycelium is intracellular, with non-cellulose walls, and penetration is effected through the root hairs. Only the much branched feeding roots are invaded, and the fungus is confined to the cortex, the central cylinder being protected by a tanniferous endoderm. Continued growth of infected roots appears to be possible only when invasion is mild; as a rule, a very severe attack causes the death of the root. A detailed account is given of the anatomy of the root and of the distribution of the endophyte in the root system. New roots formed in the spring are infected from the soil, not from the older roots, the endophyte in which is entirely cast off with the disintegrating cortex.

The vesicles are only apparent in portions invaded for a long time, when the fungus has reached its maximum development, chiefly during the second year after the roots form. The mycelium has been traced from the root hairs back into the soil, where it occurs chiefly in the debris from dead wood in which it sometimes forms vesicles similar to those found in the root [see also this *Review*, iii, p. 539].

STARK (N. V.). О микоррязе в корнях Папоротника **Angiopteris Hoffm.** [On the mycorrhiza in the roots of the Fern *Angiopteris* Hoffm.]—*Bull. Jard. Bot. Rép. Russe*, Leningrad, xxiv, pp. 141–144, 1925. [German summary. Received June, 1926.]

With a view to establishing whether the roots of the fern *Angiopteris evecta*, cultivated for over 70 years at the Chief Botanic Garden in Leningrad, contained the same mycorrhizal organism as that described by West in England (*Ann. of Botany*,

xxxi, 121, p. 77, 1907), the roots of the plants were examined by the author at regular monthly intervals over a full year. During the whole time the secondary laterals and the very fine rootlets were found to harbour a fungus forming characteristic vesicles and arbuscles, while it was never found in the young, thick, aerial roots and very seldom in the old roots. The morphological characters of the fungus [a description of which is given], as well as the formation in the spring and summer of yellow chlamydospores, allowed the author to identify it with *Stigeosporium marattiacearum* West. In his opinion, the fungus is an obligatory commensal of the roots of this fern, from which it passes into the soil, and from the latter back into the young roots as they form.

UPPAL (B. N.). **Relation of oxygen to spore germination in some species of the Peronosporales.**—*Phytopath.*, xvi, 4, pp. 285–292, 1926.

Sporangia of *Phytophthora colocasiae* were shown to be capable, under suitable temperature conditions, of forming zoospores in cultures from which the air had been exhausted by means of a vacuum pump or withdrawn by alkaline solutions of pyrogallic acid.

Indirect germination (by zoospores) also occurred in the case of sporangia of *Phytophthora infestans*, *P. palmivora*, and *P. parasitica* in the absence of oxygen, but in no instance was direct germination (by a germ-tube) observed under these conditions in any species of *Phytophthora*.

The sporangia of *Cystopus candidus*, *Plasmopara viticola*, and *Sclerospora graminicola*, as well as the conidia of *Peronospora parasitica* and *P. trifoliorum* (which germinate directly), require the presence of oxygen for germination.

GOSS (R. W.). **Transmission of Potato spindle-tuber by cutting knives and seed piece contact.**—*Phytopath.*, xvi, 4, pp. 299–303, 1 pl., 1926.

This is a more detailed description of the writer's experiments in the transmission of potato spindle tuber by cutting knives and seed piece contact than that already noticed from an abbreviated account [see this *Review*, v, p. 443].

TILFORD (P. E.). **Potato leaf roll in Ohio.**—*Bimonthly Bull. Ohio Agric. Exper. Stat.*, xi, 2, pp. 55–59, 2 figs., 1926.

This paper deals with the symptoms, means of transmission, incidence, economic importance, and suggested means of control of leaf roll of potato in Ohio.

Evidence based on experimental data indicates that the average loss incurred as a result of leaf roll amounted in 1925 to a 20 to 46 per cent. decrease in the number of tubers per hill, and 41 to 65 per cent. loss in weight. The use of northern-grown certified seed appears to give better results than that of Ohio-grown seed. The latter is difficult to keep free from leaf roll, and in a comparative test selected northern seed gave a crop entirely without leaf roll, whereas there was between 7 and 8 per cent. in the crop from Ohio seed.

McLEAN (W.). **Effect of leaf-roll disease in Potatoes on the composition of the tuber and 'mother tuber'.**—*Journ. Agric. Science*, xvi, 2, pp. 318–324, 1 graph, 1926.

In continuation of his work on leaf roll disease in potatoes [see this *Review*, v, p. 380], the author describes investigations of the comparative chemical composition of healthy and leaf roll infected tubers.

The results indicate that one effect of leaf roll in its secondary form is to reduce the percentage of dry matter in the tubers. The percentage of nitrogen in the dry matter is appreciably higher than in the tubers from healthy plants. This difference is sufficiently outstanding in many varieties to characterize leaf roll tubers where the only variable factor is that of leaf roll disease.

The rate at which the nutrient materials are removed by the young plants from infected mother tubers when the latter are sprouted is much slower than in the case of plants from healthy stock. This may be the cause of the stunting which is characteristic of leaf roll plants.

When there is any doubt as to the diagnosis of secondary leaf roll by the usual symptoms, a determination of the dry matter in the mother tuber, two or three months after planting, would in all probability help in reaching a decision. It is thought that the striking difference in composition and rate of loss in weight during storage between tubers obtained from infected plants in the first season but showing no symptoms, and tubers obtained from plants showing secondary disease symptoms, may prove of great significance in the further investigation of the disease.

QUANJER (H. M.). **Waarnemingen over 'kringerigheid' of 'vuur' en over 'netnecrose' van Aardappelen.** [Observations on 'sprain' and 'net necrosis' of Potatoes.]—*Tijdschr. over Plantenziekten*, xxxii, 4, pp. 97–128, 1 pl., 1926. [English summary.]

The identity of the various potato diseases which are liable to confusion with 'kringerigheid' (which the author identifies with sprain as known in the British Isles) is discussed at some length, with reference to the work of contemporary investigators, the conclusion being reached that 'eisenfleckigkeit', 'buntfleckigkeit', and 'propfenbildung' (Appel's Taschenatlas der Kartoffelkrankh., Parey, Berlin, 1925) are at any rate in some cases synonymous with sprain, while internal brown or rust spot and net necrosis, the causation of which by *Pseudomonas solaniolens* is not accepted by the author [see this *Review*, iii, p. 420], are distinct from sprain (which does not seem to be known in the United States) and from each other.

Sprain, which is stated to be of considerable importance in sandy and peaty soils in Holland (the so-called 'Veenkolonien'), starts from some point at the surface of the tuber, passing the vascular ring, and penetrating the interior until a corky barrier is formed in the parenchyma, which in cut tubers appears as a ring (Dutch 'kring', hence the name 'kringerigheid'). In some varieties the ring or rings are divided into narrow strips; sometimes they expand into small blotches; while in certain varieties they may be seen on the surface, often developing from the point where second

growth occurs or from surface scars. When the respiratory processes are cut off from portions of the interior by the formation of rings, death of the cells ensues and cavities develop.

In sections of tubers affected either by net necrosis or sprain (of which the former generally increases in storage while the latter remains practically stationary), or by late blight (*Phytophthora infestans*), the cells surrounding the dead parenchyma are obstructed by a brown deposit which fills the intercellular spaces and impregnates the walls. These cells in turn are enveloped by a continuous sheet of tubular-shaped, densely packed cork cells, thus forming a double barrier as in the process of healing cut surfaces of tubers [see this *Review*, ii, p. 384].

All attempts to isolate an organism from potatoes affected by sprain or by net necrosis have given negative results. The results of field experiments [presented in tabular form] indicate that both lime and potash have the property of reducing sprain infection, while the substitution of a complete fertilizer (nitrogen, potash, and basic slag) has been found by Cleveringa (*Versl. Rijk en Provincie Landbouwproefvelden in Noordelijk Gelderland over 1921 en 1922*, 1923) to be more efficacious in the restoration of the soil than the addition of potash to organic manure. Green manures also appear to be beneficial, while the cultivation of turnips accentuates the disease-inducing condition of the soil. Among the varieties which have been found resistant to sprain in recent experiments may be mentioned Energie, Preferent, Robijn, Roode Star, Ceres, Triumph, Trenctria, Alpha, Bevelander, Parnassia, Pepo, Kerr's Pink, Shamrock, Burbank, Early Harvest, and Irish Cobbler.

LEACH (J. G.). **The relation of the Seed-Corn maggot (Phorbia fusciceps Zett.) to the spread and development of Potato blackleg in Minnesota.**—*Phytopath.*, xvi, 3, pp. 149–176, 1 pl., 12 figs., 1 graph, 1926.

Further details are given in regard to the association between potato blackleg in Minnesota (where it is stated to be a general bacterial necrosis of the stems not necessarily correlated with infection by any particular species) and the seed-corn maggot (*Phorbia fusciceps*) [see this *Review*, iv, p. 374].

The insect deposits its eggs, which are commonly superficially contaminated with phytopathogenic bacteria, on or in the soil near healthy seed-pieces or sprouts. The larvae inoculate the seed-pieces with the bacteria and aid the development of the disease by destroying or preventing the formation of wound cork. The bacteria are constantly associated with the insect from the larval stage to the adult fly, in the intestinal tract of which they commonly occur.

Sterile maggots, obtained from surface-sterilized eggs, were unable to grow on sterile potato tubers but made normal growth when bacteria were added, showing that the latter are essential to the development of the insects.

Preliminary experiments indicate that a thin coating of corrosive sublimate over the surface of cut seed-pieces may be effective in the prevention of this type of injury.

Israilski (V. P.) & Runow (E. V.). Устойчивость сортов Картофеля к бактериальным заболеваниям и вирулентность бактерий. [Resistance of Potato varieties to bacterial diseases, and virulence of bacteria.]—*Morbi Plantarum*, Leningrad, xiv, 1, pp. 1–6, 1925. [German summary. Received June, 1926.]

In the experiments briefly described in the present note, 18 named varieties of potato were tested in the laboratory for their resistance to infection with *Bacterium fluorescens*, *Bact. xanthochlorum*, and a closely related organism isolated by the authors from rotted stored potato tubers. In preliminary tests the latter was proved to be pathogenic to potato tubers, which began to rot on the second day after inoculation at a temperature of 10° C. It is ashort, motile rod, Gram-negative, fluorescent, and when cultivated for a long time on meat-peptone-agar it forms abundant crystals which sometimes entirely fill the medium. The potato varieties tested varied greatly in their susceptibility to all three organisms, from entire immunity in the variety Svitez to great susceptibility in the varieties Imperator Richter and Sechswochige, but no correlation was observed between starch content of the tubers and susceptibility.

The virulence of the bacteria was gradually decreased by continuous transfers to meat-peptone-agar, but was restored, and even accentuated by one or more passages through potato tubers and through earth, the latter confirming Bredemann's suggestion that the growth of bacteria in the soil may increase their virulence. The admixture of 25 mg. of chloride of lime to 100 gm. soil did not kill the bacteria, but greatly reduced their virulence in regard to potato tubers.

Fellows (H.). **Relation of growth in the Potato tuber to the Potato scab disease.**—*Journ. Agric. Res.*, xxxii, 8, pp. 757–781, 5 pl., 7 figs., 1926.

Studies on the growth of the potato tuber in relation to the occurrence of scab (*Actinomyces scabies*) were made in Wisconsin during 1921–2, two varieties of potatoes (Irish Cobbler and Early Ohio), representing elongated and round tubers, respectively, being used.

The results of these experiments, which are described in detail, appear to indicate that the formation of scab lesions occurs in growing tissues, rapidly growing tubers becoming infected only at the apical end which is the chief region of growth in such tubers. The growing area is covered with an epidermis or an incompletely formed corky layer, in which the natural openings (stomata or young lenticels in process of formation) afford entrance to the fungus. The tissue in the vicinity of the eyes is also often infected. In every case determined, infection occurred through a lenticel or stoma. Small, undeveloped tubers, which are generally covered with a corky protective coat at the basal end and a heavily cutinized epidermis at the apical end, failed to become infected after inoculation. Neither did the disease appear in large mature tubers which were no longer growing and were almost entirely covered with cork in which no new natural openings were forming.

For infection to be successful it appears that growing and dividing

cells are necessary. The effect of the organism extends along the subepidermal phellogen by way of the middle lamella which was found to be thickened and darkened. The cells of the subepidermal layer are in a state of active division while new cork is being formed, and infection stimulates further division and the production of masses of corky cells. The stimulus is believed to be due to the production of a toxin.

CARTWRIGHT (KATHERINE). **On the nature of the resistance of the Potato to wart disease.**—*Ann. of Botany*, xl, 108, pp. 391–395, 1 pl., 1926.

The results of an examination of young potato shoots revealed no anatomical differences between the varieties respectively susceptible to, and immune from wart disease (*Synchytrium endobioticum*), the former represented by Arran Chief, Midlothian Early, and Ninetyfold, and the latter by Great Scot, Tinwald Perfection, Edzell Blue, and Kerr's Pink.

The degree of infection was little affected by changes of temperature. Infections were obtained at temperatures from 58° to 80° F., the most successful results being secured at about 60° under conditions conducive to healthy growth of the tubers.

The zoospores of the fungus were found to be capable of penetrating the epidermal cells of young shoots of the immune variety Great Scot. For the first two days the organism appears to develop normally, but after that time it shrinks and finally dissolves. Resistance, at least in this variety, is thus not due to a capacity to prevent invasion, but to some physiological characteristic of the epidermal cells which exerts a destructive effect on the parasite after entry.

GUENTHER. **Die Pflanzenschutzbestimmungen.** [The plant protection regulations.]—*Obst- und Gemüsebau* [formerly *Deutsche Obst- und Gemüsebauzeit.*], lxxii, 5, pp. 76–77, 1926.

The necessity is urged for the promulgation of uniform plant protection regulations in Germany, which is stated to be the only European country still lacking a definite system of legislation in this respect. A bill formulating the provisions of such a system was presented two years ago by the Ministry of Agriculture in conjunction with the provincial authorities, but this was shelved on financial grounds, and there appears little likelihood of its reintroduction for some considerable time.

Ecuador. Verordnung, betreffend die Einfuhr von Tieren und Pflanzen, die für die Landwirtschaft bestimmt sind. [Ecuador. Order governing the import of animals and plants destined for agricultural purposes.]—*Amtl. Pflanzenschutzbestimmungen* (*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*), 6, pp. 108–109, 1926.

As from 1st January, 1926, all living plants, seeds, shoots, scions, and the like imported into Ecuador must be accompanied by a duly authenticated statement vouching for their freedom from fungous diseases or insect pests.

HOLM (A.). **Government Notice No. 217. The Diseases of Plants Prevention Ordinance, 1910.**—*Official Gazette of Kenya*, 26th May, 1926.

In view of the existence of mosaic disease of sugar-cane on a number of farms in the Nyanza Province of Kenya, the Director of Agriculture prohibits, under the powers granted to him by the Diseases of Plants Prevention Ordinance, 1910, the growing of any variety of cane other than Uba during the period from 1st June, 1928, to 1st June, 1930, within a scheduled area which includes the infected farms and a wide zone surrounding them.

Oesterreich. Verordnung des Bundesministeriums für Finanzen im Einvernehmen mit dem Bundesministerium für Land- und Forstwirtschaft vom 24. Jänner 1926, betreffend das Verbot der Ein- und Durchfuhr von krebskranken oder krebsverdächtigen Kartoffeln. [Austria. Order of 24th January, 1926, of the Federal Ministry of Finance in conjunction with the Federal Ministry for Agriculture and Sylviculture governing the prohibition of the import and transport of Potatoes infected, or suspected of infection, by wart disease.]—*Amtl. Pflanzenschutzbestimmungen* (*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*), 6, pp. 111–112, 1926.

As from 5th February, 1926, all consignments of fresh potatoes imported into Austria from Denmark, the German Republic, France, Great Britain and Ireland, the Netherlands, Poland, Switzerland, and Czecho-Slovakia (Bohemia, Moravia, and Silesia only) must be accompanied by a duly authenticated statement to the effect that wart disease [*Synchytrium endobioticum*] has not been observed either in the place of cultivation or within a radius of at least 10 km.

Union der sozialistischen Sowiet-Republiken. Einfuhr lebender Pflanzen. [Union of Socialist Soviet Republics. Import of living plants.]—*Amtl. Pflanzenschutzbestimmungen* (*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*), 6, p. 116, 1926.

It was announced on 3rd March, 1926, by the Trade Delegation in Germany of the Union of Socialist Soviet Republics that consignments of potatoes for Russia must be accompanied by a duly authenticated declaration of freedom from wart disease [*Synchytrium endobioticum*].

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

VOL. V | OCTOBER | 1926

ESMARCH (F.). **Untersuchungen zur Biologie des Kartoffelkrebses. I.** [Investigations on the biology of Potato wart. I.]—*Angew. Bot.*, viii, 2, pp. 102–135, 1926.

In continuation of his investigations begun in 1923 of the conditions governing the liberation of the zoospores and germination of the resting sporangia of *Synchytrium endobioticum* [see this *Review*, iii, p. 477], the author has carried out experiments on the latter phenomenon as affected by the degree of humidity and chemical composition of the soil and by the action of root secretions.

The results of the experiments [which are described in detail] indicate that the resting sporangia, which were severely parasitized in several cases by *Phlyctochytrium synchytrii* [see this *Review*, iv, p. 186], germinate freely only in the presence of abundant soil moisture. At 30 per cent. of the water holding capacity, the percentage of germination was 9·9, whereas at 105 per cent. it was 78·4. Alternations of drought and moisture stimulated the germination of a portion of the sporangia while the remainder were killed.

The germination of the resting sporangia was not influenced by the secretions from the roots of susceptible or immune potatoes or of other plants. At the same time, the possibility of a chemotactic stimulus proceeding, e. g., from potato tubers or stolons is not excluded.

The percentage of germination in soil extracts was markedly increased in all the tests by garden soil and clay, and in some also by sand and light soil. This is thought to be due to the presence in such extracts of water-soluble chemical substances rather than to the effect of soil reaction.

The germination of the sporangia was further found to depend upon their degree of maturity. The fluctuations in the germination percentage in different series of tests are attributed to the varying age of the sporangia contained in the same wart. Warts held under dry conditions contain fewer ripe sporangia than those kept moist.

Germination was found to occur principally during the first month of the tests, the percentage gradually decreasing down to ultimate cessation, even in the presence of continuously favourable external conditions. The non-germinating sporangia are thought to be those that have not reached the requisite degree of maturity.

KÖHLER (E.). **Fortgeführte Untersuchungen über den Kartoffelkrebs.** [Continued investigations on wart disease of Potatoes.] —*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xiv, 3, pp. 267–290, 1 pl., 21 figs., 1926.

Using a modification of Spieckermann's and Kotthoff's method of testing potatoes for immunity from wart disease (*Synchytrium endobioticum*) [see this *Review*, iii, p. 600], in which the layer of damp sand was replaced by compost, the writer continued his studies [see this *Review*, iv, p. 371] on the cytology of the parasite in relation to the process of infection, and the nature of resistance.

The shoots growing in the infested soil developed radially formed galls both on the shoot axes and leaves. In addition to the previously mentioned [loc. cit.] elevated and depressed galls, stalked and sessile galls are distinguished as variants, the former occurring exclusively on shoot axes, while the latter may be found on any organ.

The results of greenhouse inoculation experiments [the technique of which is fully described] on shoots of potato tubers of resistant and susceptible strains showed that the varieties comprised in the latter group are characterized by the subterranean transformation of the invaded shoots into proliferations. Infected shoots which reach the surface are covered with galls and more or less strikingly deformed, e.g., Rubia, Deodara, Industrie. Varieties of the resistant type seldom form typical proliferations, and when these do occur they are so slight as to be readily overlooked. Some of the resistant varieties show no infection at all, while in others the development of the fungus is so much impeded that the sorus does not reach the migration stage or sporangial formation (sub-infection). In yet other cases the sori ripen and macroscopically discernible galls are formed.

According to the behaviour of the shoots, the resistant varieties may be grouped under the following headings: (1) no sub-infections, no pustules, e.g., Beseler, Parnassia; (2) few sub-infections, occasional pustules, e.g., Arnica; (3) numerous sub-infections, fairly often accompanied by pustules, e.g., Hindenburg; and (4) numerous large pustules and striking deformity of infected shoots, e.g., Preussen.

The F_1 generation of a cross between Weisse Riesen and Hindenburg segregated into three resistant to one susceptible plant, while the F_1 generations of two crosses between Weisse Riesen and Preussen segregated into one resistant to one susceptible.

SCHULZE (R. W.). **Der Kartoffelkrebs, die grosse Gefahr des Kartoffelbaues.** [Wart disease of Potatoes, the great menace to Potato cultivation.]—*Obst- und Gemüsebau* [formerly *Deutsche Obst- und Gemüsebauzeit.*], lxxii, 11, pp. 168–169, 1926.

A brief, popular account is given of the distribution, symptoms,

and modes of transmission of wart disease of potatoes (*Chrysophlyctis endobiotica*) [*Synchytrium endobioticum*], together with a list of the varieties known to be immune in Germany, and a short summary of current legislative measures against the spread of infection.

McKay (M. B.). **Potato wilt and its control.**—*Oregon Agric. Exper. Stat. Bull.* 221, 23 pp., 12 figs., 1926.

This is a condensed form of the author's paper already noticed from another source [see this *Review*, v, p. 515]. It is prefaced by a brief illustrated description of the symptoms of attack characteristic of the wilt caused by *Verticillium albo-atrum*.

A farm plan is added showing the positions suggested for the location of potato seed-plots separate from the main field, and their relation to the other crops each year in a four-year rotation period.

Curzi (M.). **La tracheo-verticilliosi della Patata in Italia.** [Tracheoverticilliosis of the Potato in Italy.]—*Riv. Patol. Veg.*, xvi, 3–4, pp. 77–83, 1926.

A diseased condition of potatoes due to infection by a species of *Verticillium* was observed for the first time in Italy at Foligno [Umbria] in September, 1925. The morphological and cultural characteristics of the causal fungus were found to coincide with those described by other investigators for *V. albo-atrum* on the potato, but the author points out that the descriptions of this fungus on other hosts are often so divergent as to suggest that distinct species are involved.

Inoculation experiments are described which indicate that the stage of development of the host plant influences infection in a manner generally similar to that described by the author in the allied disease of chilli pepper (*Capsicum annuum*) due to *V. tracheiphilum* [see this *Review*, v, p. 206].

It is thought probable that the disease has been present in Italy in the past without attracting special attention. The infection at Foligno was not traced to the use of diseased seed but appeared to come from infected soil. Transmission through the seed tubers was, however, clearly demonstrated in the author's pot experiments. The affected tuber appears at first to give rise to healthy shoots, but sooner or later symptoms of disease develop in the foliage, curling of the lower leaves being often one of the first to appear. At this stage the blackened mycelium can be found in the vessels of the lower portions of the stalks and has been traced back into those of the tuber.

Poole (R. F.). **Cultural methods for reducing Sweet Potato losses caused by stem rot.**—*New Jersey Agric. Exper. Stat. Bull.* 433, 10 pp., 6 figs., 3 graphs, 1926.

The writer has obtained excellent control of stem rot of sweet potatoes (*Fusarium batatatis* and *F. hyperoxysporum*) [see this *Review*, v, p. 347] in susceptible strains of the Jersey and Porto Rico varieties by the use of two or three plants, instead of one, per hill. It has been found that the disease, even during the most virulent period (July and August), seldom kills all three plants, and

an almost perfect stand has been obtained on plots where 17 and 46 per cent. of single plants were destroyed, and in some such cases the increased yield amounted to 30 to 50 per cent.

MITCHELL (J.). **Report of Organising Secretary on visits to estates.**—*Fourth Rept. Exec. Ctte. Rubber Res. Scheme* (*Ceylon*). *Proc. during the year 1925*, pp. 10–13, 1926.

Visits to 55 estates in all the rubber-growing districts were made during 1925.

Further substantial improvement in respect of freedom from *Fomes lignosus* was noted, and it would seem evident that with prompt and thorough treatment the severity of this disease in Ceylon may be greatly reduced. *F. lamaoensis* was also of comparatively slight importance. On the other hand, there are indications that the root disease caused by *Ustulina zonata* is likely to become the most serious factor in Ceylon plantations, and the closest attention should be paid to it. A method of control which appears likely to lead to a complete cure, or at least to a considerable prolongation of the life of affected trees, has been devised by the Mycologist to the Scheme [see next abstract] and is described in the fourth Quarterly Circular for 1925.

No importance need be attached to the occurrence of *Poria hypobrunnea*, *Sphaerostilbe repens*, or *Xylaria thwaitesii* under present conditions in Ceylon.

There was a severe outbreak of secondary leaf fall and pod disease (*Phytophthora*) [? *meadii*] in the Kalutara district at the beginning of the south-west monsoon, but the dry weather of early July arrested the progress of infection. In view of the successful results of spraying in South India [see this *Review*, v, p. 53], considerable attention is now being given to this method of control.

Black stripe canker or bark rot [*Phytophthora* sp.] was much less severe than in previous years, partly owing to the dry weather in July, but mainly as a result of the routine application of disinfectants to the tapping cuts.

The heavy scraping for the control of patch canker [*P. faberi*: see next abstract] has been almost abandoned, and great care is now given to the selection of coolies for canker work, with the result that a considerable improvement in this respect can be recorded.

There was no marked increase in the incidence of brown bast during 1925, and the importance of adhering to conservative methods of tapping is strongly emphasized. Frequent tapping for the purpose of securing large yields must necessarily lead to an increase in brown bast. A combination of scraping with the isolation method advocated by Keuchenius [see this *Review*, iv, p. 766] is now being recommended.

Oidium [*heveae*: see this *Review*, iv, p. 702] was reported to cause a leaf fall for the first time in Ceylon, from the Kalutara district, in March and April.

STOUGHTON-HARRIS (R. H.). **Mycologist's Report for 1925.**—*Fourth Rept. Exec. Ctte. Rubber Res. Scheme* (*Ceylon*). *Proc. during the year 1925*, pp. 22–25, 1926.

A special study of the anatomical and pathological features of

rubber trees affected by pod disease and leaf fall (*Phytophthora*) [? *meadii*] showed that young leaves, especially of pollarded trees, were particularly liable to attack. The results of manuring experiments in connexion with leaf fall indicate that the cover on plots fertilized with nitrate of soda (5 cwt. per acre) was at least 10 per cent. denser than on those not so treated.

A strain of *P. faberi* (believed to have been originally isolated from cacao) was inoculated into cut petioles and leaves of rubber trees and reisolated from the diseased tissue. The bark of living trees, inoculated with this revitalized culture, developed the typical symptoms of patch canker, the uninoculated controls remaining healthy. The results of similar tests with the same strain of *P. faberi* were negative as regards the production of black stripe canker [*Phytophthora* sp.].

An extensive investigation on the value of disinfectants in the control of black stripe canker is in progress. The effective inhibiting concentration for the preparations hitherto tested are as follows: paranitrophenol, 0·006 per cent.; izal, 0·1 per cent.; brunolinum cresoleum, 0·1 per cent.; brunolinum hybol, 0·1 per cent.; arboretas, 0·1 per cent. (or less); phenol, 0·2 per cent.; brunolinum plantarium, 0·2 per cent.; mono-chlornaphthalene, 0·4 per cent.; agrisol, 0·5 per cent.; carbolineum hevearum, 0·5 per cent.; and cargillineum (emulsified with 1 per cent. soap), 1 per cent.

Experiments were conducted to test the effect of the reaction of the media on the growth of *P. faberi*. It was found that between P_H 4·0 and 7·0 the rate of growth is approximately constant. Above and below this range, the fungus exhibits the phenomenon of staling, which also occurred on media of high concentration. Between P_H 4·5 and 5·5 there is a critical range within which a small decrease in P_H value causes a very considerable decline in the amount of growth of the fungus. This fact may have some bearing on the effect of control measures against *P. faberi*.

Cross inoculation experiments with a species of *Oidium* on *Euphorbia hirta*, which is morphologically identical with that on rubber, have so far given negative results.

A method of filling in the cavities in the roots of trees suffering from *Ustulina* [*zonata*] and other root diseases, after the removal of the rotted tissues, has been devised and promising results have been obtained from its use.

TAYLOR (R. A.). **Physiological Botanist's Report for 1925.**—*Fourth Rept. Exec. Ctte. Rubber Res. Scheme (Ceylon). Proc. during the year 1925*, pp. 18–21, 1926.

The data obtained from the annual census on the incidence of brown bast on a plot of 1,000 trees in Kalutara [see this *Review*, iv, p. 634] showed a steady increase during the three years 1923, 1924, and 1925. The present percentage of badly diseased trees is estimated at 9·6, but many more are stated to show incipient symptoms of infection, the total of affected individuals being placed at 24·5 per cent.

During the latter half of the year a preliminary experiment was made to test the validity of the 'exhaustion' theory of the disease [see this *Review*, iv, p. 187]. Two equal cuts, approximately one-

third of the circumference, were opened on either side of each of ten healthy trees which had not been tapped for 18 months. All the trees were tapped daily, but from one cut on each tree the flow of latex was restricted by the application of alcohol immediately after tapping. The first examination (after two months' tapping) showed two trees with both panels affected, and two with brown bast on the restricted side only. Subsequently one more tree was found to have developed the disease on the restricted side. These data are opposed to the 'exhaustion' theory, but further experiments on a larger scale are requisite for their confirmation.

LEPLAE (E.). **La culture de l'Hévéa au Congo Belge.** [The cultivation of *Hevea* in the Belgian Congo.]—*Rev. Bot. Appliquée*, vi, 56, pp. 204–218, 8 pl., 2 graphs, 1926.

In a note on the fungous diseases of *Hevea* rubber in the Belgian Congo [pp. 212–213] it is stated that root diseases (especially *Fomes*) have caused severe losses at Yangambi-Gazi and that die-back and leaf fall (*Phytophthora*) [? *meadii*] is also common.

VAN HEURN (F. C.) & STEINMANN (A.). **Over het optreden van kringrot op Java.** [On the occurrence of ring rot in Java.]—*Arch. Rubbercult. Nederl.-Indië*, x, 3, pp. 117–118, 3 pl., 1926.

The appearance of ring rot ('kringrot') disease of rubber [*Hevea brasiliensis*: see this *Review*, ii, p. 8] on four plantations in West Java is recorded for the first time.

The cause of the disturbance, which was reported by Keuchenius in 1920 from Sumatra and the Malay Peninsula, is still obscure. There appears to be no anatomical difference between the bark of the normal and diseased regions, apart from the undulations revealed by transverse sections through the tissue layers. Below these undulations there was no anatomical change in the parenchymatous tissue. The affected layer is superficial, extending, according to Keuchenius, only half-way through the cortex.

Closer examination showed that the concentric grooves develop as a result of the desiccation and peeling off of the outer hard bark. Keuchenius believed that the disease was due to fungous infection through superficial wounds, and drew attention to a sepia discoloration of the affected region during the so-called 'active stage' of the malady. This symptom, however, has in no case been observed by, or reported to, the writers.

EAST (E. M.) & WESTON (W. H.). **A report on the Sugar Cane mosaic situation in February, 1924, at Soledad, Cuba.**—*Contrib. Harvard Inst. Trop. Biol. & Med.*, I, 52 pp., 9 pl. (5 col.), 1925. [Received May, 1926.]

In this, the first of a new series of publications from Harvard University devoted to tropical biology and medicine, an account is given of the mosaic disease of sugar-cane as seen by the authors on the Soledad estate, Cuba. The disease is thought to be of long standing in Cuba and, at Soledad, it is not appreciably reducing the yield and quality of the Crystalina cane ordinarily grown in the island. Some of the illustrations show mosaic and certain

other types of chlorosis in maize. There is a bibliography of 128 titles.

TENGWALL (T. A.). **Wortelrot in verband met E K 28 na E K 28.** [Root rot associated with consecutive planting of E K 28.]—*Arch. Suikerind. Nederl.-Indië,* xxxiv, 16, pp. 413–415, 1926.

Discussing the possible bearing of rotation on the incidence of root rot in the E K 28 variety of sugar-cane [see this *Review*, v, p. 187] in the Dutch East Indies, the writer thinks there is no scientific basis for the prevalent belief that the rotation of this variety with others, such as E K 2 or D I 52, reduces the amount of infection. However, the results of experiments carried out in 1924–5 indicate that in certain localities there was a definite increase of infection and reduction of yield as a result of planting E K 28 two years in succession. It is desirable that similar tests should be conducted on a large scale, since the importance of this question is very great. It should be remembered that this method of varietal rotation must necessarily involve a considerable reduction of yield, since where it is generally practised it becomes impossible to select exactly the right type of soil for each individual variety.

OWEN (W. L.). **The prevention of the deterioration during storage of raw sugars by their inoculation with torulae.**—*Intern. Sugar Journ.*, xxviii, 328, pp. 198–203, 1926.

This is an extract from a paper published in *Facts about Sugar* on the author's investigations into the antagonistic activities of torulae towards the development of mould fungi in raw sugars.

Inoculations of raw sugars with suitable torulae results in the formation of carbon dioxide within the molasses films surrounding the sugar crystals, and this inhibits mould growth. Tests to determine the concentration of CO_2 held within the films, the amount required to prevent inversion of the sucrose by moulds, and the time required for this amount to be developed by the torulae led to the following conclusions. When the sugar was sprayed with 5 per cent. by weight of filming molasses inoculated with suitable torulae polarization was increased, reducing sugars were diminished, and deterioration from moulds was checked. The net gain in value due to the increase in polarization in inoculated samples averaged \$3·50 per ton of raw sugar. The concentration of CO_2 required for the prevention of mould growth is apparently about 0·036 per cent. by weight, this being usually reached during the first or second week after inoculation. Other beneficial results of these inoculations are to make the sugars less hygroscopic and lighter in colour.

CIFERRI (R.) & GONZÁLEZ FRAGOSO (R.). **Hongos parásitos y saprofitos de la República Dominicana (5ª Serie).** [Parasitic and saprophytic fungi of the Dominican Republic (5th Series).] —*Bol. R. Soc. Española Hist. Nat.*, xxvi, 4, pp. 248–258, 6 figs., 1926.

Amongst the species enumerated in this part of the authors' series of papers on Dominican fungi, the following may be mentioned. *Glomerella psidii*, causing a spotting of guava (*Psidium*

guajava) fruits which is somewhat rare: *Sphaerella rosigena* on living leaves of cultivated roses: *Ophiobolus passiflorae* n. sp., which produces dry, irregular, ill-defined spots, up to 10 by 5 mm., on living leaves of *Passiflora tuberosa* and is characterized by epiphyllous (rarely hypophyllous), globular, black perithecia, up to 220 μ in diameter; by clavate to oblong asci, measuring 80 to 90 by 10 to 14 μ; and by fasciculate, cylindrical, pluriguttulate or 8- to 10-septate, hyaline (later yellowish) ascospores, measuring 45 to 60 by 3 to 4 μ: *Phyllosticta passiflorae*, associated with the foregoing on leaves of *P. tuberosa*: *P. perseae*, producing scattered, reddish-brown spots on living leaves of avocado (*Persea gratissima*): *Gloeosporium manihotis* on young branches of cassava (*Manihot utilissima*) and *Cercospora henningsii* producing round, dry spots on leaves: *Colletotrichum gloeosporioides* on leaves and fruit, and *Pestalozzia mangiferae* on foliage of mango (*Mangifera indica*): *Cladosporium epiphyllum* on living leaves of cherry (*Prunus cerasus*), associated with insect injury: *Cercospora mucunaecola* n. sp., which forms numerous irregular, dry, ill-defined, whitish spots, measuring 0·5 to 5 mm., on living leaves of *Mucuna pruriens* [*Stizolobium deeringianum*], and is characterized by dark-coloured, fasciculate, tortuous conidiophores, up to 55 by 5 to 6 μ; and by clavate, 3- to 10-septate, hyaline to yellowish conidia, up to 95 by 5 to 5·5 μ; *C. bolleana* on living leaves of fig (*Ficus carica*): *C.* [*Cercosporina*] *ricinella* on living leaves of castor (*Ricinus communis*): and *Cercospora sesami* on living leaves of *Sesamum*.

Buchheim (A. N.). Некоторые наблюдения над распространением и биологией мучнисто-росных грибов в окр. Москвы. [Some observations on the distribution and biology of the Erysiphaceae in the neighbourhood of Moscow.]—*Morbi Plantarum* Leningrad, xiv (1925), 1, pp. 34–38, 1925. [German summary. Received June, 1926.]

As a result of his observations on the biology of the Erysiphaceae during the period from 1922 to 1924 in the neighbourhood of Moscow, the author states that under the local conditions the perithecia are usually formed from three to six weeks after the appearance of the conidia, this interval apparently being somewhat shorter in the middle than at the beginning of the summer. Further research is needed to establish whether the fluctuations in this interval of time depend on the different species or forms of the fungi concerned, on the varying physiological conditions of the host tissues, or on meteorological factors. A list is given of host plants for Erysiphaceae which the author discovered during his investigations and which had not been previously recorded in the region.

During the summer of 1924 oak mildew was very prevalent around Moscow. The first symptoms were noted in the second half of May, and the first perithecia were found about four weeks later. Successful artificial inoculations in the laboratory of young leaves of *Quercus pedunculata* with ascospores from overwintered perithecia showed that spring infection may be transmitted by perithecia that overwinter on fallen leaves. The fact that near Moscow perithecia are abundantly formed on oak leaves confirms the author in his view that the fungus should be provisionally kept in the

collective species *Microsphaera alni*, until there is a revision of the genus *Microsphaera*, in which biologic characters are taken into consideration.

BERNARD (C. H.). **Verslag over het Algemeen Proefstation voor Thee over het jaar 1925.** [Report of the General Tea Experiment Station for the year 1925.]—*Meded. Proefstat. voor Thee*, xcv, 26 pp., 1926.

This report contains the following references of phytopathological interest (pp. 9–11). The most serious root diseases of tea in Java were those caused by *Fomes pseudoferreus* [see this *Review*, v, p. 54], *F.* [*lignosus*] (*Rigidoporus microporus*) [ibid., iv, p. 636], *Rosellinia*, and, at high altitudes, *Armillaria* [*mellea*].

Red rust (*Cephaleuros virescens*) [*C. mycoidea* and *C. parasiticus*: see this *Review*, iii, p. 4] was prevalent on weakened plants, and the grey dadap fungus (*Septobasidium bogoriense*) [ibid., v, p. 253] occurred in a serious form for the first time. The sporadic development of pink disease (*Corticium salmonicolor*) was also reported. The two last-named fungi further caused serious damage to *Tephrosia candida*. *Albizzia moluccana* was attacked by mildew [*Oidium* sp.], causing the defoliation and death of seedlings, in certain districts.

EYLES (F.). **Tobacco mosaic in Southern Rhodesia. Selection for resistance.**—*Rhodesia Agric. Journ.*, xxiii, 3, pp. 248–252, 1926.

The author discusses virus diseases in general, and more particularly the conditions favourable to the overwintering and spread of tobacco mosaic in Rhodesia, where in some seasons it causes severe damage. The occurrence of this mosaic in certain perennial weeds has already been reported in America, where their eradication has led to a reduction in infection on tobacco [see this *Review*, iv, p. 400]. Mosaic has been noticed recently on a common Rhodesian weed, *Ceratotheca triloba*, and the possible transmission of the disease from this weed to tobacco is under study.

The occurrence of wildfire (*Bacterium tabacum*) on Rhodesian tobacco [see this *Review*, iv, p. 194] is confirmed.

MAJOR (T. G.). **Soil treatment with various disinfectants. Preliminary report.**—*Scient. Agric.*, vi, 8, pp. 283–285, 1926.

An account is given of comparative tests made at the Central Experimental Farm, Ottawa, with a number of organic mercury and formaldehyde preparations as tobacco seed-bed soil disinfectants. The preparations included germisan, uspulun, Bayer compound, semesan, kalimat, super-kalimat, Bayer dust, and Dupont dusts Nos. 12 and 13.

No definite conclusions as to the relative values, and the proper concentrations and rates of application, can be drawn at the present stage of investigation. The following points seem, however, to be fairly well established.

Dust treatments control diseases such as black root rot (*Thielavia basicola*), but injure the germination and stand too severely to be of practical value. The liquid formaldehyde preparations appear

to injure the host plants to a lesser extent than the liquid mercuric compounds, but in the case of kalimat permitted a rather high percentage of *Thielavia* infection. Of the mercuric preparations, semesan gave the least satisfactory results.

RUDOLPH (B. A.). **Verticillium wilt of Tomatoes in California.**—*Phytopath.*, xvi, 3, p. 234, 1926.

A very serious wilt disease of tomatoes occurring in the San Francisco Bay region of California has been found to be due to a species of *Verticillium* resembling *V. albo-atrum* [see this *Review*, iv, p. 574]. The fungus, which was found to be identical with the *Verticillium* responsible for black heart of apricots [see this *Review*, iv, p. 47] and also with that causing blue stem of raspberries [see this *Review*, iv, p. 748], was proved to be pathogenic by successful inoculations on greenhouse tomatoes. Monospore cultures of the *Verticillium* from raspberries, apricots, and tomatoes attacked the last-named host with equal readiness, the typical symptoms of wilt being produced in each case. The fungus from these same sources also caused wilting of Myrobalan plum seedlings and young Ranaree raspberry plants.

DUFRÉNOY (J.). **La cytologie du Blepharospora cambivora Petri.** [The cytology of *Blepharospora cambivora* Petri.]—*Comptes rendus Soc. de Biol.*, xciv, 13, pp. 997–999, 3 figs., 1926.

A cytological study of *Blepharospora cambivora*, the cause of the ink disease of chestnuts in southern Europe, is stated to have revealed cytoplasmic conditions similar to those known in the genus *Saprolegnia*, to which *Blepharospora* is considered to be closely allied.

FOKIN (A. D.). К экологии „черни"—**Fumago vagans Pers.** [Contribution to the ecology of sooty mould—*Fumago vagans* Pers.]—*Morbi Plantarum*, Leningrad, xiv (1925), 1, pp. 29–33, 1925. [Received June, 1926.]

Sooty mould ('*Fumago vagans*') is stated to have been extremely prevalent on a large number of plants [a list of which is given] in the town and government of Vyatka [eastern Russia] in the autumn of 1923, a correlation being drawn by the author between this prevalence and the local atmospheric conditions of that year. It was noted that the fungus chiefly appeared on plants heavily attacked by honeydew-forming insects, but the presence of the latter did not necessarily entail the development of sooty mould. The optimum temperature for the growth of the fungus in the open apparently lies between 17° and 21° C. during the daytime, while prolonged exposure to temperatures above 23° or below 5° inhibits the fungus. The optimum relative humidity is from 70 to 90 per cent., especially when maintained during the whole day, the minimum being 50 per cent. Diffuse light would appear to be essential, as it was observed that the mould always developed on the upper surface of the leaves (with the exception of erect leaves, on which it developed on both sides), while direct sunlight apparently killed the fungus. A remarkable feature of the outbreak was that in no

case were pycnidia or perithecia observed, so that it was impossible to determine the species involved.

Karakulin (B. P.). О взаимоотношении конидиальных стадий **Septomyxa** и **Marssonina**, встречающихся на Клене и о связи их с сумчатой формой **Gnomonia**. [The correlation between the conidial stages of *Septomyxa* and *Marssonina* occurring on Maple, and their connexion with the ascigerous form *Gnomonia*.]—*Morbi Plantarum*, Leningrad, xiv (1925), 2–3, pp. 73–81, 1925. [German summary. Received June, 1926.]

After a review of the literature dealing with the genera *Septomyxa* and *Marssonina*, the author states that in his observations made since 1922 at the Chief Botanic Garden in Leningrad fructifications of *Septomyxa negundinis* Allesch. were always found in great abundance on the dead branches of the Chinese maple (*Acer negundo*) and on the dead fruit still adhering to the trees. In the middle of the summer the fungus appeared on living leaves and on young, green shoots, causing a necrosis of the bark and gradually killing the shoots. On the petioles and laminae of dead leaves (whether kept over winter in Klebahn's frames or in the open), as well as on the branches attacked by *S. negundinis*, perithecia developed in the following spring, and these were identified as belonging to a biologic form of *Gnomonia cerastis* (Riess) (syn. *Sphaeria cerastis* Riess) which the author names f. *negundinis*. A Latin diagnosis of this form is given. Inoculation experiments and observations made on pure cultures established the fact that *S. negundinis* is the imperfect stage of the perithecial form. On the leaves *S. negundinis* was morphologically indistinguishable from *Marssonina decolorans* Kab. et Bub., with which it is regarded as identical.

MacDougal (W. T.). **Reversible variations in volume, pressure, and movements of sap in trees.**—*Carnegie Institute of Washington Publication* 365, 90 pp., 5 pl., 16 diags., 7 graphs, 1925.

The pathological anatomy and physiology resulting from defoliation from girdling and heat injury to the stems of trees are discussed, particularly on pp. 21, 64 et seq., and 89. *Pinus radiata* was the tree studied. Removal of leaves in the autumnal resting condition resulted in death of the tree within a few months. The blocking of the perforations in the bordered pit membranes by resin is suggested as one of the means by which induction is stopped under certain pathological conditions.

Leffelman (L. J.) & Hawley (R. C.). **Studies of Connecticut hardwoods. The treatment of advance growth arising as a result of thinnings and shelterwood cuttings.**—*Yale Univ. School of Forestry Bull.* 15, 52 pp., 17 figs., 1925. [Received July, 1926.]

The trees are classified as seedlings, seedling-sprouts (sprouts

arising from stumps less than 2 inches in diameter at the ground line), and sprouts (arising from stumps more than 2 inches basal diameter). In the latter class part of the original root system usually dies, while in the seedling-sprout class the entire original root system is often utilized by the new tree. The prevalence of decay renders the sprout class extremely undesirable from the economic standpoint. Even in 4-year-old sprouts 28 per cent. showed decay which had entered from the old decaying stump or roots. While rot enters earlier in sprouts, in a 60- to 80-year rotation many sprouts will be sound. As the length of the rotation increases the relative value of this growth form becomes less and less. Seedling-sprouts in which only a single sprout has arisen from the stump, though liable to wind throw because of the one-sided character of the root system, approach seedlings in freedom from butt rot. Where several seedling-sprouts have arisen from the same stump, there is more chance for decay because some of these multiple sprouts are killed by competition and in decaying infect the living sprouts. Examination of 400 root systems showed that seedlings had the healthiest roots, with single seedling-sprouts, multiple seedling-sprouts, and sprouts following in the order given. The study was primarily on the five local oak species, but birches, ashes, and *Acer rubrum* were also numerous in the stands studied. *Quercus coccinea* is described as particularly susceptible to butt rot.

BONDARTZEFF (A. S.). О распространении домовых грибов в Ленинграде. [On the distribution of house fungi in Leningrad.]—*Morbi Plantarum*, Leningrad, xiv (1925), 1, pp. 41–42, 1925. [Received June, 1926.]

Wood-rotting fungi are stated to have developed in a threatening manner in a considerable number of buildings in Leningrad, the most widely distributed being *Merulius lacrymans* and *Poria vaporaria* (in 50 and 30 per cent. of the cases respectively). Next in importance comes *Coniophora cerebella*, which was diagnosed in about one-third of the remaining 20 per cent. of infections. The other fungi determined were *Fomes roseus*, *Paxillus acheruntius*, *Poria undata*, *P. vulgaris*, *P. sanguinolenta*, *Lenzites sepiaria*, *Trametes serialis*, *Merulius aureus*, and a species of *Corticium*. In many cases the infection was mixed, two or even three species being found in association.

DAVIS (W. H.). **The house fungus Merulius lacrymans (Jacq.) Fr.**—*Proc. Iowa Acad. Sci.*, xxxi (1924), pp. 169–173, 1 fig. [Received May, 1926.]

During 1922–4 an investigation was made of the damage caused by *Merulius lacrymans* to the floor and adjacent wooden structures of a church at Amherst (Massachusetts). It was found that whitewood [? *Liriodendron tulipifera*], southern and white pine [*Pinus palustris* and *P. strobus*], and spruce [*Picea*] timbers were rotted in one year, while chestnut wood was resistant. Inoculation experiments with pure cultures of the fungus also showed that poplar, whitewood, and pine decayed much sooner than chestnut.

NOWOTNY (R.). **Ueber Erfahrungen bei der Holzimprägnierung nach dem Cobraverfahren.** [Experiments in timber preservation by the Cobra process.]—*Zeitschr. Angew. Chemie*, xxxix, 13, pp. 428–431, 4 figs., 1926.

The Cobra Timber Preservation Association has devised what is claimed to be a new method of wood preservation which is briefly outlined as follows. By means of small, portable appliances a number of holes, several centimetres in depth, are made in the basal portion of telegraph poles and the like: into these holes a pulpy antiseptic (consisting mainly of sodium fluoride with an admixture of dinitrophenolsodium and zinc chloride) is simultaneously injected. The remaining portion of the poles, which is much less exposed to infection, is protected by the surface application of a strong germicide. This process, which is alleged to be much more economical than the usual methods of timber preservation, is stated to have already been successfully adopted, especially in Germany, where more than 250,000 poles were treated between 1921 and 1924. The examination in 1925 of 4,000 poles which had been standing for 3½ to 4 years showed complete freedom from decay.

In this method the use of air-dry wood is not necessary, or even desirable, since the diffusion of the antiseptic is more rapidly effected in the presence of moisture. The advantages of using freshly felled wood for structural purposes are manifest: they include the saving both of time and of transport costs and the obviation of fungous infection in stacked timber.

The writer's tests showed that the sodium fluoride (detected by the use of a 0·25 to 1 per cent. solution of ferric thiocyanate which is decolorized by contact with the fluoride, the rest of the wood staining blood-red) uniformly penetrated further than the dinitrophenolsodium which stained the wood bright yellow.

TCHOUMAKOVA (Mme E. E.). К вопросу о способах борьбы с рассадочным грибком. [On the means of controlling the seedling fungus.]—*Morbi Plantarum*, Leningrad, xiv (1925), 2–3, pp. 105–108, 1925. [Received June, 1926.]

The author continued in 1925 her experiments on the control of the seedling fungus, *Moniliopsis aderholdi*, on the same general lines as in the former series [see this *Review*, v, p. 73]. The results again showed that actively boiling water was most effective in controlling the organism; practically as good results were also obtained by disinfecting the earth in the pots with toluol at the rate of 15 c.c. per 12 sq. cm. of soil surface. Germisan and uspulun did not check the development of the fungus but had a marked stimulating effect on the germination of the cabbage seed.

VAUGHAN (R. E.) & WELLMAN (F. L.). **Club root of Cabbage.**—*Wisconsin Agric. Exper. Stat. Circ.* 200, 3 pp., 3 figs., 1926.

A description is given in popular terms of club-root of cabbage [*Plasmodiophora brassicae*], which is stated to be causing increasing damage every year in Wisconsin. Directions are given for the control of the disease by appropriate sanitation and the applica-

tion of lime to infested fields at the rate of 2 to 4 tons per acre.

HERTEL (F.). **Versuche mit dem Kohlherniemittel 'Höchst.'** [Experiments with the preparation 'höchst' for the control of club-root of Cabbage.]—*Obst- und Gemüsebau* [formerly *Deutsche Obst- und Gemüsebauzeit.*], lxxii, 5, pp. 67–69, 2 figs., 1926.

In 1925 the writer carried out, on slightly alkaline, sandy clay soil near Leipzig, a series of tests [the results of which are presented in tabular form] in the control of club-root [*Plasmodiophora brassicae*] on red, white, and Savoy cabbage, cauliflower, and kohlrabi. Of the various methods used, the most satisfactory results were given by the admixture with the soil of 'höchst' (Meister Lucius and Brüning, Höchst-am-Main) applied at the rate of 100 gm. per sq. m. (average of 20·75 per cent. infection compared with 74·79 per cent. in the untreated plots). The highest yield was also given by the plots treated with this preparation. The results of a preliminary test indicate that pouring a solution of 20 gm. uspulun, tillantin B, or germisan in 10 l. of water over each plant, or mixing uspulun or tillantin B with the soil, do not give satisfactory control.

PAPE (H.). **Pilzparasitäre Krankheiten der eingemieteten Zucker- und Futterrüben.** [Parasitic fungous diseases of stored Sugar and Fodder Beets.]—*Illus. Landw. Zeit.*, xlvi, 14, pp. 176–177, 1926.

Brief notes are given on the storage diseases of beets caused by *Sclerotinia sclerotiorum*; *Botrytis cinerea*; *Typhula betae* [see this *Review*, iv, p. 521], which occasionally causes heavy damage in Germany, e.g., in Saxony in 1924, and is stated by Molz to be responsible for severe losses in the Azores; *Fusarium betae* and *F. udum*; *Rhizoctonia violacea*; and *Phoma betae* [loc. cit.].

GILCHRIST (GRACE G.). **The nature of resistance to foot rot caused by Ascochyta sp. and some other fungi in the epicotyl of the Pea.**—*Phytopath.*, xvi, 4, pp. 269–276, 1 pl., 1 graph, 1926.

Previous investigations of the diseases of garden peas [*Pisum sativum*] have shown that a group of parasitic fungi, including a species of *Ascochyta* causing a foot rot of peas in Wisconsin and previously referred to the genus *Phoma* [see this *Review*, v, p. 69], enter the base of the epicotyl more frequently that the other parts of the underground stem or root.

Microscopic observations and experiments on the rate of evaporation have shown that the susceptible region at the base of the epicotyl has a much thinner cuticle than the middle and upper portions of the first internode.

Inoculations with the *Ascochyta* [the foot rot caused by which is briefly described], and also field observations, have shown that in varieties that are generally disease-resistant, e.g., Rice's No. 330, Horal, and Black-eye Marrowfat, the cuticle at the base of the epicotyl is better developed than in the susceptible ones, such as Saxa, Alaska, Horsford, and White Marrowfat. This is thought to

be at least one of the factors concerned in varietal resistance or susceptibility to the disease.

LUDWIG (C. A.). **Pseudomonas (Phytomonas) pisi Sackett, the cause of a pod spot of garden Peas.**—*Phytopath.*, xvi, 3, pp. 177–183, 1 pl., 1926.

A pod spot of peas observed near Latta, South Carolina, in 1922, was found to be caused by an organism believed to be a strain of *Pseudomonas pisi*, previously described as the agent of a stem blight of field and garden peas in Colorado (*Colorado Agric. Exper. Stat. Bull.* 218, 1916). The spots are translucent in the early stages, later yellowish, and finally brown. Severe infection may result in the desiccation and death of young pods. The organism was shown to be an active parasite on wounded pods, stems, and leaves, occasionally developing also in the absence of apparent injury. *P. pisi* retained its viability for over a year in nutrient agar cultures. The Telephone variety appears to be more susceptible than the Lightning Excelsior or Extra Early Alaska. The development of resistant or immune varieties is regarded as the most promising means of control.

BURGWITZ (G. K.). **Бактериальный ожог и пятнистость Сои (Glycine hispida Maxim.).** [Bacterial blight and spotting of Soy-bean (*Glycine hispida* Maxim.).]—*Morbi Plantarum*, Leningrad, xiv (1925), 1, pp. 38–41, 1925. [German summary. Received June, 1925.]

After a cursory review of the literature on bacterial diseases of the soy-bean known in North America and in the Far East, the author states that soy-bean (*Glycine hispida*) seedlings raised at the Chief Botanic Garden in Leningrad, on soil never before used for this crop, from seeds received from Urga, Mongolia, developed a severe spotting of the leaves which gradually spread all over the plants. A study of the symptoms and of the causal organism, which was isolated in pure culture, led to the conclusion that the disease was the bacterial blight caused by *Bacterium glycineum* [see this *Review*, i, p. 418]. The fact that the disease occurred in a locality where the plant was never cultivated before shows that it may be introduced with imported seed. It would appear that the disease is present in Mongolia, where, however, it has not been officially recorded.

BAUNACKE [W.]. **Gefürchtete Seuchen der Champignonzüchten.** [Alarming diseases of cultivated Mushrooms.]—*Die Kranke Pflanze*, iii, 4, pp. 65–68, 1926.

One of the most important diseases of cultivated mushrooms [*Psalliota campestris* and *P. arvensis*: see this *Review*, iv, p. 167] in Germany is the well-known 'môle' or abortion disease (*Mycogone perniciosa*), which is stated by Costantin and Dufour to cause annual losses of 10 to 25 per cent. in the Paris mushroom beds. The writer has observed two distinct forms of this disease, in one of which the stipes are abnormally short and the pilei distorted and frequently marked by a black spotting; while the other and

more striking manifestation is characterized by the complete absence of a pileus and a pronounced swelling of the stipe.

Another disturbance, known as 'false plaster of Paris', is caused by *Monilia fimicola* or *Verticilliopsis infestans*, which produces a floury, white coating on the young mushrooms and the manure covering them.

According to Delacroix, the 'verdigris' disease (*Myceliophthora lutea*), characterized by the development of white (later yellowish) flakes measuring at most 1 mm. in diameter, is more widely distributed and causes heavier damage than the foregoing.

Mushroom beds which have become contaminated by *Clitocybe candicans* or *Pleurotus mutilus* emit a characteristic sharp odour.

In addition to general cultural measures [which are briefly indicated] the disinfection of the soil, walls of frames, cellars, and the like, with a 2 to 2·5 per cent. lysol solution is recommended for the control of *M. perniciosa*.

VIALA (P.). **Recherches sur les maladies de la Vigne: esca.** [Investigations on Vine diseases: esca.]—*Ann. des Épiphyties*, xii, 1–2, pp. 1–108, 4 col. pl., 80 figs., 1926.

This is a full account of the author's investigations, over a period of 20 years, into the esca disease or apoplexy of the vine [see this *Review*, v, p. 468].

Esca, a name which the author prefers to apoplexy, occurs throughout the French vineyards and all along the Mediterranean coast [see this *Review*, iii, p. 315]. It was thought for some time to be caused chiefly by *Fomes igniarius*, but the fact that a species of *Stereum* was isolated much more frequently from affected vines, together with the results of morphological and cultural studies of the two fungi, lead the author to conclude that the true cause of the disease is a species of *Stereum* to which he applies the name *S. necator*, while stating that it might be considered as merely a variety (*necator*) of *S. hirsutum*.

The fructifications of the fungus, in the form of small, yellowish-white, concentrically zoned sporophores, at first effused and then reflexed or sometimes unilaterally attached by a rudimentary stalk, are described in detail. They are very rare on the vine, on which they appear in October or early spring, as many as 50 being found distributed all over the trunk or sometimes on a main branch. The largest scarcely exceed 4 by 2 cm. in diameter, 2 by $1\frac{1}{2}$ cm. being about the average size.

In culture, a white, downy mycelium, similar to that observed penetrating the black zone around the rotted centre of vine stems, was first obtained. This mycelium is composed of regular, pearly white hyphae ($1·5\,\mu$ in diameter), with a thick membrane, finely granular contents, and infrequent septa. Clamp-connexions are occasionally found. In the tissues of diseased vines the hyphae occur in bundles, penetrating the vessels, medullary ray cells, and fibres. The mycelium constituting the 'amadou' in the centre of the stem is composed of yellow or brownish hyphae ($2\,\mu$ in diameter) which have a thicker membrane and are provided with clamp-connexions. Occasionally almost black hyphae are found in the central zone. These are often united into bundles and are three or

four times as broad as the lighter hyphae and with rather more frequent septa. A similar mycelium also develops in pure culture.

From the dark mycelium elongated sclerotial cordons, 120–500 μ in diameter, are formed, especially in the dead vine tissues. On these cordons conidia are borne singly at the apex of each hypha. The conidia, which formed only in four- to five-year-old cultures, measure 10 to 10·5 by 6 to 6·5 μ, are subspherical or slightly reniform, simple, and of a light brown colour, darkening in the larger spores. Plate-like sclerotia also occur, especially in culture, and ultimately break up into a mass of small elements, capable of germinating; these form a kind of powder, the dissemination of which may be largely responsible for the spread of the disease.

In addition to these forms of propagation a further conidial stage is found under certain conditions. In artificial cultures in liquid media, tube-like hollows develop in the condensed mycelium and are lined with filaments containing endoconidia of the type known in *Ceriomyces*. These are spherical, 1 to 1·5 μ in diameter, 3 to 12 in each hypha, and are liberated by the dissolution of the wall of the latter. They germinate rapidly in water.

The author's inoculation experiments have hitherto failed to reproduce the symptoms of esca. His recommendations for treatment are similar to those already described in earlier notices of this disease. Short notes are also given on *Fomes igniarius* and *Polyporus hispidus*, the former of which is an occasional vine parasite, while *P. hispidus* is the cause of a serious mulberry disease and was observed attacking the vine on one occasion.

FOËX (E.) & AYOUTANTIS (A.). **D'une production rouge à consistance gélatineuse que revêt parfois la Vigne au printemps.** [On a red gelatinous substance which sometimes covers the Vine in spring.]—*Bull. Soc. Myc. de France*, xl, 4, pp. 318–331, 1 pl., 1 fig., 1926.

This is a full illustrated description of the red gelatinous growth which sometimes covers the limbs of the vine in the spring and which, as already reported, is stated to be composed of a *Fusarium*, identified as *F. viticola*, in addition to green algae and numerous bacteria [see this *Review*, iv, p. 255].

PATWARDHAN (G. B.). **Appendix M. Annual Report of the Plant Pathologist to Government of Bombay, Poona, for the year 1924–25.**—*Ann. Rept. Dept. of Agric. Bombay Presidency for the year 1924–5*, pp. 156–158, 1926.

The following references of phytopathological interest are contained in this report.

A study of the gummosis of citrus trees showed that this disease is confined exclusively to the Mosambi variety (*Citrus aurantium*), usually affecting the collar and in severe cases the scale buds and branches. Satisfactory results were obtained by the excision of all wounded parts followed by cleansing with pure water and the application to the exposed portions of a 50 per cent. solution of crude carbolic acid, with a final coating of coal tar.

Detailed observations on the outward symptoms of sclerotial wilt of potatoes (*Sclerotium rolfsii*) were made. The parasitic nature

of this fungus on both growing plants and tubers was definitely proved.

A fruit rot of pomegranate [*Punica granatum*] due to a species of *Phoma* was reported to cause heavy losses; a wet rot sets in near the stalk and results in the dropping of the fruits and flowers.

Germisan was found to give equally good results against smut (*Sphacelotheca sorghi*) of jowar [sorghum] as copper sulphate.

Immature coco-nuts were attacked by a species of *Diplodia* not previously observed in Poona.

DASTUR (J. F.). **Annual Report of the Mycological Section for the year ending 31st March, 1925.**—*Rept. Dept. of Agric., Central Provinces and Berar, for the year 1924–25*, pp. 23–26, 1926.

Inoculation experiments with the *Fusarium* believed to be the cause of wilt disease of cotton at Dharwar [see this *Review*, v, p. 489] again gave negative results. The *Fusarium* usually present in wilted cotton plants in the Central Provinces was further shown to occur both in 'wilting' and 'non-wilting' soils: this organism is similar to the Dharwar fungus and to that described by Ajrekar and Bal [ibid., i, p. 292]. Field and pot culture experiments were greatly hampered by the incidence of the *Rhizoctonia* disease [ibid., iii, p. 77], which was responsible for heavy losses. Promising results as regards resistance to wilt were given by a variety of cotton supplied by the Economic Botanist. *Gossypium roseum* and *G. neglectum verum* (strain AK 2) are stated to be highly susceptible, while AK 4 is very resistant.

Excellent results in the control of jowar [sorghum] smut [*Sphacelotheca sorghi*] have been obtained by dusting the seed with copper carbonate at the rate of $\frac{3}{4}$ oz. per 6 seers [= nearly 5 kg.], the cost of the preparation being Rs. 3·5 per lb. Germisan was also found effective. Both these preparations were found to be equally efficacious with copper sulphate and more convenient in application, but they are not readily obtainable in the native quarters.

The disease of pan [*Piper betle*] reported last year from Drug [*Phytophthora* sp.: see this *Review*, iv, p. 718] has caused extremely heavy losses during the period under review. Preliminary experiments in its control by the application of Bordeaux or Burgundy mixture gave some hope of success, but owing to lack of co-operation on the part of the growers it was impossible to pursue this line of treatment.

Foot rot, generally associated with a species of *Fusarium*, appears to be the most important disease of wheat. *Helminthosporium* and *Acrothecium* are occasionally observed on affected plants, and considerable damage is also caused by *Rhizoctonia* [see this *Review*, iii, p. 383]. Foot rot was most severe when the seed was sown in the third week of October, the incidence of infection declining with every week after this date until complete freedom was obtained by sowing after mid-November. Copper carbonate and germisan gave good control of the disease, especially on late-sown seed.

Three serious diseases of rice were reported from different localities, two of which appear to be new and demand further investigation, while the other was due to *Piricularia oryzae*. Ambadi

[*Hibiscus cannabinus*] was severely attacked by a species of *Gloeosporium* after the plants had flowered and set fruit.

HECTOR (G. P.). **Appendix II. Annual Report of the Economic Botanist to the Government of Bengal for the year 1924–25.** —*Ann. Rept. Dept. of Agric. Bengal for the year 1924–25*, pp. v–ix, 1925. [Received July, 1926.]

The following references of interest occur in the mycological section of this report.

An obscure disease of betel vine [*Piper betle*] is stated to be more or less prevalent throughout Bengal [see this *Review*, v, p. 148], especially during the rainy season. Experiments in the artificial production of the disease on healthy vines with fungi isolated from infected plants gave negative results.

Inoculation experiments on areca palms [*Areca catechu*] with pure cultures of *Thielaviopsis* [*paradoxa*], the causal organism of pine-apple disease, gave negative results.

During the cold weather early-planted potatoes were heavily infected by late blight (*Phytophthora infestans*). The crop sown after the last rains in November was only slightly attacked and the local variety remained healthy. This is believed to be only the third occurrence of late blight in the Bengal plains, and it was probably due to the use of infected Darjeeling seed. Considerable damage was caused in the Hooghly district by leaf blotch (*Cercospora concors*.)

A species of *Cercospora* was found causing a mild leaf-spot of sugar-cane in Chittagong during November.

LUTHRA (J. C.). **Appendix II. Annual Report of the Economic Botanist to the Government, Lyallpur, Punjab, for the year ending 30th June, 1925.**—*Rept. Dept. of Agric., Punjab, for the year ending 30th June, 1925, Part I*, pp. viii–xv, 1926.

The following references of phytopathological interest occur in this report. The incidence of root rot of cotton [see this *Review*, v, p. 19] was found to be reduced from 34 to 8 per cent. by trenching operations. The removal of kankar [concretionary limestone] also gave beneficial results.

Yellow rust of wheat (*Puccinia glumarum*) appeared late in January and was of little importance. Orange and black rust (*P. triticina* and *P. graminis*) occurred in a very mild form on late-sown wheats. Good results in the control of loose smut of wheat [*Ustilago tritici*] were given by the hot water treatment.

Three plots of gram [*Cicer arietinum*] receiving no irrigation suffered severely from wilt disease [see this *Review*, iv, p. 332], the incidence of which was greatly reduced by watering.

The sugar-cane crop raised at Ferozepore from local diseased cuttings showed 76 per cent. infection by red rot (*Colletotrichum falcatum*).

EYLES (F.). **Report of the Botanist and Mycologist for the year 1925.**—*Rept. of the Secretary, Dept. of Agric., Southern Rhodesia, for the year 1925*, p. 34, 1926.

Most of the diseased cotton submitted for examination during

the period under review was affected by angular leaf spot [*Bacterium malvacearum*], which normally appears to reduce the yield only to a limited extent.

Scab and anthracnose [*Sporotrichum citri* and *Colletotrichum gloeosporioides*] were the chief known citrus diseases observed, but a fruit disease (probably new and almost certainly derived from some wild veldt plant) requires further investigation.

Probably owing to favourable climatic conditions, the parasitic diseases of cereals and potatoes are stated to be generally much less severe in Rhodesia than elsewhere.

CAVADAS (D. S.). *Πεπραγμένα Φυτοπαθολ. Σταθμοῦ Πηλίου τοῦ Ἔτους* **1925.** [Report of the Phytopathological Station of Pelion for the year 1925.]—Volo [Thessaly, Greece], 25 pp., 5 figs., 1926. [French summary.]

During the period under review 45,000 peach and 50,000 apple trees were treated for the control of their most common parasites, namely, leaf curl (*Exoascus* [*Taphrina*] *deformans*) of the former, and scab (*Fusicladium dendriticum*) [*Venturia inaequalis*] and the insect *Carpocapsa pomonella* of the latter. In the case of the two last-named, the method consisted of three applications (before and immediately after blossoming and a fortnight later) of an alkaline Bordeaux mixture composed of 1 per cent. copper sulphate and 3·5 per cent. lime, with the addition of 0·5 per cent. lead arsenate for the second and third sprays. The results were satisfactory, the incidence of scab being reduced from 80 to 5 to 10 per cent., and that of *C. pomonella* from 60 to 10 per cent.

The single application in February of lime-sulphur for the control of peach leaf curl was washed away by heavy rain; about 100 trees treated at the same time with Bordeaux mixture (2 per cent. copper sulphate and 3 per cent. lime) remained free from the disease. The use of the latter preparation is, therefore, to be recommended in spite of its higher cost.

A severe epidemic occurred among the larvae of the olive fly (*Dacus oleae*) as the result of attacks by two organisms which have been named by the author *Micrococcus daci* and *Bacillus dacicida*. Over 99 per cent. of the larvae were found dead among the trees. The main pathogenic agent was ascertained to be *B. dacicida*, which induced the death of meat flies (*Calliphora vomitoria*) on inoculation *per os*. Both the organisms are stated to be new species, and are briefly described and contrasted with other bacterial parasites of the olive fly. Swarms of locusts (*Acridium*) on the island of Euboea [Aegean Sea] were attacked by *Coccobacillus acridiorum* d'Hérelle.

LEPIK (E.). **Fütopatoloogilised märkmed I.** [Phytopathological notes I.]—*Mitt. der Phytopath. Versuchsstat. Univ. Tartu (Dorpat)*, i, pp. 1–10, 1926. [German summary.]

This is a brief report on the principal diseases of cultivated plants which were noticed in Esthonia in 1925. The following items are of interest.

Gooseberries were severely attacked by *Puccinia ribesii-caricis* [*P. pringsheimiana*], which is not usually dangerous in the locality.

P. lolii was widely distributed on oats and *Rhamnus cathartica*. *P. dispersa* was abundant in the aecidial stage on *Anchusa arvensis* and *A. officinalis*, but damaged rye but little. *Phytophthora infestans* was more widespread than usual on potatoes, and appeared 2 to 3 weeks earlier than in former years. Winter wheats suffered particularly heavily from attacks of *Septoria graminis*, which developed in great abundance on the leaves injured by late frosts.

HARTWELL (B. L.). **Thirty-eighth Annual Report of the Director of the Agricultural Experiment Station.**—*Bull. Rhode Island State Coll.*, xxi, pp. 38–53, 1926.

The following references of phytopathological interest occur in this report. The chlorosis of early spinach [see this *Review*, iv, p. 648], oats, beets, beans, and peppers [*Capsicum annuum*] was reduced or prevented by the application of a soluble salt of manganese, and in later plantings the improved appearance of the beet leaves was to some extent reflected in the increased yield. Chlorosis of late spinach was entirely prevented by spraying with manganous chloride at the rate of 12 lb. per acre, the yield being increased by one third. Beans in pots were not injured by the manganese salt up to the equivalent of 80 lb. per acre in a nearly neutral soil, but half this amount was deleterious in an acid soil.

GEORGESON (C. C.). **Report of the Alaska Agricultural Experiment Stations, 1924.**—Washington, Govt. Printing Office, 47 pp., 22 figs., May, 1926.

This report contains references to the following plant diseases: potato scab [*Actinomyces scabies*], which was well controlled by 3 to 10 minutes' immersion of the seed in a formaldehyde solution (1 pint in 10 galls. water); oat smut [*Ustilago avenae*] on the Finnish Black variety, also effectively controlled by formaldehyde, while uspulun and copper carbonate dust were less satisfactory; barley smut [? *U. nuda*: see this *Review*, iv, p. 146] on Hybrid No. 19, which was best controlled by copper carbonate dust and steeping in uspulun, while 10 minutes' immersion in water heated to 129° F. was less effective and considerably impaired the vitality of the treated seed, as was also the case with formaldehyde; and wheat scab (*Gibberella saubinetii*) which caused considerable sterility of the heads in the Hybrid No. 30 variety.

JEHLE (R. A.) & WOOD (JESSIE I.) **Diseases of field and vegetable crops in the United States in 1925.**—*Plant Disease Reporter, Supplement* 45, 152 pp., 1926. [Mimeographed.]

This review of the diseases of field and vegetable crops has been prepared on the lines of previous reports of a similar nature [see this *Review*, iv, p. 83]. Only a few of the more interesting items are referred to here.

Spraying with Bordeaux mixture combined with arsenicals continues to be regarded as necessary in most regions for the profitable production of potatoes. The use of copper-lime and arsenic dusts has given satisfactory results in some areas, but it has not proved as uniformly successful as spraying in the control of late blight (*Phytophthora infestans*) and hopperburn.

Reports from the various States indicate that the losses due to mosaic in 1925 were greater than those from any other potato disease.

The injuries to tomatoes caused by the early blight and nailhead spot disease are of three distinct types, viz., leaf spot and fruit rot, collar rot, and nailhead spot of the fruit, the first two being associated with *Alternaria solani* and the last with *Macrosporium tomato*. The heaviest losses were reported from Florida and Louisiana. The leaf blight form of the disease appears to have been generally more destructive than the fruit spot. In Virginia the disease persisted during the dry weather, causing fruit drop and showing greater activity than *Septoria lycopersici* in the causation of leaf blight. Serious damage was recorded also in Georgia, Indiana, and Michigan. The nailhead spot manifestation of the disease is apparently limited to the southern States.

Yellow blight, the cause of which remains obscure [see this *Review*, v, p. 52], continues to be the most important tomato disease of the western States. In California it caused an estimated reduction in yield of 25 per cent. of the crop.

A new systemic vascular wilt of tomatoes has been reported from Corvallis, Oregon. The causal organism, an actively motile bacterium, is stated to be distinct from any hitherto associated with a tomato disease. *Aplanobacter michiganense* is excluded by the mobility of the bacteria and *Bacterium solanacearum* is not known to be present in the arid or semi-arid north-west.

Black rot of sweet potatoes, caused by *Ceratostomella fimbriata* (formerly known as *Sphaeronema fimbriatum*) [see this *Review*, v, p. 471], appears to be decreasing in severity owing to the general adoption of sanitary measures. In New Jersey the selection of disease-free seed and the use of healthy plant-beds have largely eliminated infection.

As a result of improved methods of handling the crop and of storage, the losses from storage rots of sweet potatoes, caused by *Rhizopus nigricans*, *Mucor racemosus*, and *Diplodia tubericola* [see this *Review*, iv, pp. 699, 757] have greatly decreased (from 30·3 per cent. in 1918 to 6·9 per cent. in 1925).

Macrophoma phaseoli, associated with a foot or stem rot of beans, was reported from South Carolina, where it was observed, for the first time in the United States, in 1923. Severe attacks of disease are stated to occur only in damp weather.

Very heavy losses in the onion seed crops in parts of California were caused by downy mildew (*Peronospora schleideni*), which attacked the leaves and primary seed stalks of the white varieties in April. The disease was most severe in fields where onions had been previously grown. The estimated loss over several thousand acres was 60 per cent. Early in June large acreages of market onions grown from seed were also attacked.

Rio Grande disease or white heart is regarded as one of the most important diseases of lettuce in western New York, where the loss for 1925 is calculated at 10 per cent. The trouble, which occurs on various soils and under different environmental conditions, is believed to be of physiological origin.

A new disease of lettuce, known as brown blight, has been reported

from California. Young plants become stunted and show a yellow to brown discoloration; when attacked after heading the wrapper and outer leaves exhibit irregular, dry, brown streaks and blotches. The disease, which is apparently caused by an unidentified soil organism, is known to occur also in Arizona. In the Imperial Valley of California the best lettuce land is rapidly becoming infected to such a degree that satisfactory cultivation will be impossible for many years. Highly resistant strains of the Iceberg variety, which is grown almost exclusively in the Pacific Coast and Rocky Mountain regions, are being developed. Big Boston (the standard shipping variety in the south and east) seems to be immune.

Bacterial blight of peas (*Bacterium pisi*) was somewhat more prevalent than usual in eastern Virginia, Kentucky (on the Little Marvel variety), South Carolina, Wisconsin, and Minnesota.

Cotton blight (*Ascochyta gossypii*) was again reported from North and South Carolina [see this *Review*, iv, p. 528] and recorded for the first time in Alabama and Mississippi. In the first-named State the disease assumed an epidemic form in the wet season of 1924, whereas in the dry summer of 1925 it was much less serious. In Mississippi the plants in the small infected area were completely destroyed.

A very severe outbreak of cotton leaf spot caused by *Alternaria* sp. was reported from the Salt River Valley of Arizona in 1925, the disease occurring also in Virginia, Mississippi, Arkansas, and California. The humid weather conditions in the early autumn in Arizona appear to have been particularly favourable to the rapid development of the fruiting stage of the fungus. Infection was most severe on the Pima long staple variety and caused early defoliation.

A fungus believed to be identical with *Ascochyta nicotiana*, not previously reported from the United States, was collected on tobacco in Tennessee in 1924. Black shank (*Phytophthora nicotianae*) [see this *Review*, iv, p. 317] was reported from southern Georgia and Florida, causing a reduction in yield of about 10 per cent. in the latter State, where the acreage of cigar wrapper tobacco was only about one-third as large in 1925 as in 1924.

The following diseases of pigeon pea [*Cajanus indicus*] were reported from Porto Rico; leaf spots (*Cercospora instabilis* Rangel, *Phyllosticta* sp., and *Vellosiella cajani* Rangel); anthracnose (*Colletotrichum cajani* Rangel); rust (*Uromyces dolicholi*); and damping-off (*Rhizoctonia ferruginea*).

CIFERRI (R.). **Informe de patología vegetal y entomología agricola.** [Report on plant pathology and agricultural entomology.]—*Primer Informe Anual de la Estación Agron. y Col. de Agric. de Haina, República Dominicana, 1 de Abril–31 de Diciembre de 1925*, pp. 27–36, 1926.

The following are some of the chief records of phytopathological interest in the first report of the Haina Agricultural Station, Dominican Republic, other than those already noticed from different sources.

A rot of the heart wood of citrus trees associated with the

presence of *Polystictus* spp. occasionally follows the attacks of primary parasites.

A disease of cacao described from the Yabón valley (Sabana de la Mar) in 1912 appears to be due to a species of *Monilia* which attacks the branches and is evidently distinct from that causing pod rot in Ecuador.

Two leaf spot diseases of coffee (*Coffea arabica*) are equally widespread, namely, *Cercospora coffeicola* and *Stilbella* [*Omphalia*] *flavida*, the latter occurring chiefly in very shady and damp plantations. A root rot due to *Rosellinia* spp. was found to be causing damage in a number of localities.

Guava (*Psidium guajava*) is extensively infected by black leaf spot (*Meliola amphitricha*); and a form of silver leaf, apparently not due to *Stereum purpureum*, was observed.

The groundnut (*Arachis hypogaea*) crop of Haina is stated to be devastated by rust (*Uredo arachidis*). *Cercospora personata* is widespread, chiefly as a secondary parasite on old leaves. Another species of *Cercospora* is also believed to occur in the Republic. Some damage has been caused by a root rot probably due to *Rhizoctonia* sp.

A blight of mangosteen (*Garcinia mangostana*) leaves, caused by *Pestalozzia espaillatii* Cif. et Frag., was observed at Santiago. The most important and widespread disease of maize in the Dominican Republic is smut (*Ustilago zeae*). An epidemic of anthracnose of pepper (*Capsicum annuum*), due to *Colletotrichum nigrum* in association with a species of *Fusarium* and subsequently with certain schizomycetes, was reported from San Francisco de Macoris, while the leaf spot due to *Cercospora capsici* is stated to be widespread but of little economic importance.

LIESKE (R.). **Kurzes Lehrbuch der allgemeinen Bakterienkunde.** [A short text-book of general bacteriology.]—Berlin, Gebr. Borntraeger, viii + 388 pp., 118 figs., 1926.

This text-book is stated in the author's preface to contain, in a condensed form, all essential information constituting a general basis for the study of special aspects of bacteriology (medical, agricultural, botanical, and industrial). The work is divided into the following sections: historical development of bacteriology; taxonomy of the bacteria; dissemination of bacteria in nature; the morphology and physiology of bacteria; enzymes; the effect of external influences on bacteria; bacterial symbiosis; antagonistic relations between bacteria and higher organisms (including eight pages on bacteria in relation to plant diseases); the bacteriophage; special biological groups of bacteria and allied organisms; and technical methods in bacteriology. The many photographic illustrations are for the most part original, whilst numerous bibliographical references are given as footnotes.

SPAFFORD (W. J.). **Some diseases of Wheat crops and their treatments.**—*South Australia Dept. of Agric. Bull.* 190, 16 pp., 1925. [Received 1926.]

This is a popular description of the symptoms and life-history of the fungi causing diseases of wheat in South Australia, with direc-

tions for their control. Bunt (*Tilletia tritici*) may be treated by immersion of the seed-grain in 1 per cent. copper sulphate or 0·25 per cent. formalin, or by thorough dusting with copper carbonate (containing 50 to 55 per cent. metallic copper and passing through a 200-mesh screen to the extent of 90 per cent.) at the rate of 2 oz. per bushel.

Loose smut (*Ustilago tritici*) is stated to be of little importance, but it may be controlled where necessary by three hours' immersion in water heated to 110° to 115° F.

Cultural methods are recommended for the control of flag smut (*Urocystis tritici*), take-all (*Ophiobolus graminis*), foot rots (*Helminthosporium* spp. and *Wojnowicia graminis*), red rust (*Puccinia graminis*), and mildew (*Erysiphe graminis*).

Copper carbonate as a bunt preventive.—*Agric. Gaz. of New South Wales*, xxxvii, 5, p. 402, 1926.

In order to test the effect on germination of copper sulphate and copper carbonate as used for the prevention of bunt of wheat [*Tilletia tritici* and *T. levis*], seed-grain wassown 18 days after treatment with dry $CuCO_3$ and one and 14 days, respectively, after immersion in 1½ per cent. copper sulphate. The former gave a germination percentage of 94, compared with 77 for seed sown the day after treatment with $CuSO_4$, and 63 when the seed had been treated with $CuSO_4$ a fortnight previous to sowing. The seed in the first case germinated four days ahead of the other two lots, and the stand was more even.

KIESSELBACH (T. A.). **Winter Wheat investigations.**—*Nebraska Agric. Exper. Stat. Res. Bull.* 31, 149 pp., 28 figs., 2 graphs, 1925. [Received August, 1926.]

The following references of phytopathological interest occur in this extensive account of the work on winter wheat breeding which has been carried out for the last twenty years at the Nebraska Agricultural Experiment Station.

The conditions favouring the development of black stem rust [*Puccinia graminis*] are stated to be high temperature and high humidity accompanied by dew, or rain followed by sunshine. Orange leaf rust [*P. triticina*] is more common but less injurious than stem rust. Kanred is the only winter wheat that has proved materially more resistant to *P. graminis* than ordinary Turkey Red. In the severe epidemic of 1920 Kanred showed 19 per cent. infection compared with 49 per cent. in Turkey Red, whilst Nebraska No. 28 showed only 18 per cent. infection, escaping the epidemic by virtue of its precocity. Since 1923 Kanred appears to have declined in resistance.

Bunt of wheat [*Tilletia levis*], which has assumed alarming proportions of recent years, may be successfully controlled by the use of the standard formalin or copper carbonate treatments, which in 1924 reduced the amount of infection from 38 to 1 and 2 per cent., respectively, the yield being correspondingly increased from 27·5 to 33·1 and 34 bushels per acre. In another plot the amount of bunt was reduced from 63 to 2 and 8 per cent. by formalin and copper

carbonate, respectively, and the yield augmented by 14·1 and 13·7 bushels per acre.

LINDFORS (T.). **Berberisutrotningen i Sverige.** [Barberry eradication in Sweden.]—*Landtmannen*, ix, 21, pp. 412–413, 1926.

The present status of the barberry (*Berberis*) [*vulgaris*] eradication campaign in Sweden is regarded as very unsatisfactory, chiefly owing to lack of adequate organization. The need for an extended system of propaganda, especially in the matter of practical demonstrations of the work of eradication, accompanied by explanations of its importance, is emphasized. A study of the special local conditions prevailing in the different areas, and the collection of statistical data on the ravages of black stem rust [*Puccinia graminis*] in relation to the presence of barberry bushes are also necessary. It is suggested that the sum of Kr. 7,184, which is at present held in reserve for the work of eradication, be expended in the creation of a special post, in connexion with the Central Institute for Agricultural Research, for the furtherance of the campaign.

NATTRASS (R. M.). **Report on seed 'pickling' investigation.**—*Ann. Rept. Agric. & Hort. Res. Stat., Long Ashton, Bristol, for 1925*, pp. 110–112, 1926.

Samples of wheat treated with various disinfectants against bunt [*Tilletia tritici*] together with untreated samples were collected from a number of farms in the west of England and sent to the Seed Testing Station, Cambridge, for germination determinations.

It was found that various treatments with copper sulphate (mostly 1 lb. to 1 gall. water for each sack of wheat) reduced germination 21, 10, 9, and 3 per cent., respectively, but increased it 6 per cent. in the case of one sample of poor seed. Formalin (about 1 tablespoonful in 1 or 2 galls. for each sack) had no effect on germination in one case, but in two others reduced it by 1 and 2 per cent., respectively. Corvusine also had no effect in one case and reduced it by 10 per cent. in another. Seed treated with tar and then with lime had 6 per cent. less germination. No bunt was seen in any of the crops grown from treated seed.

LAMBERT (E. B.), RODENHISER (H. A.), & FLOR (H. H.). **The effectiveness of various fungicides in controlling the covered smuts of small grains. Results of the co-operative cereal seed treatment project of the Crop Protection Institute.**—*Phytopath.*, xvi, 6, pp. 393–411, 1926.

The results of the extensive co-operative tests on cereal seed treatment carried out from 1922 to 1924 in eleven American States and four Canadian provinces are discussed and presented in tabular form.

The primary object of the project was a comparison of the general efficacy of copper carbonate dust with the standard formaldehyde treatment in the reduction of smuts and the stimulation of germination and yield of wheat, oats, and barley. Nickel carbonate dust, copper sulphate plus lime dust, semesan dust, and uspulun and semesan solutions were also tested.

Bunt of wheat [*Tilletia tritici* and *T. levis*] and the smuts of

hull-less oats [*Ustilago levis*] were best controlled by copper carbonate dust (2 to 3 oz. per bushel). The seed was not appreciably injured, infection was practically eliminated, and a tendency to increased yield was manifest.

Formaldehyde dip (1 in 320) or spray (1 in 1, applied at the rate of 1 qt. of dilute solution per 50 bushels of grain) controlled these smuts more completely than any other material, but frequently impaired germination, especially that of hull-less oats. Semesan and uspulun (0·3 and 0·25 per cent., respectively) were less efficacious than formaldehyde.

In the case of hulled oats the formaldehyde spray gave the best results and copper carbonate proved much less effective.

Covered smut of barley [*U. hordei*] was also best controlled by formaldehyde. No injury to the seed was caused by any of the treatments.

Owing to the absence of systematic replication of the experimental plots, no definite conclusions could generally be drawn regarding the effect on yield of the different treatments. However, the results obtained in the control of smut on hull-less oats with copper carbonate dust were so consistent and noteworthy that the increased yield must be at least partially attributed to the treatment.

LEUKEL (R. W.). **Further experiments on the control of bunt of Wheat and the smuts of Barley and Oats.**—*Phytopath.*, xvi, 5, pp. 347–351, 1926.

In continuation of previous experiments [see this *Review*, v, p. 221] in the control of bunt of wheat [*Tilletia levis*], loose and covered smut of oats [*U. avenae* and *U. levis*], and covered smut of barley [*U. hordei*], the writer carried out a series of tests with some selected fungicides.

Of the twenty dusts used against bunt in Purplestraw wheat, copper carbonate was found most satisfactory in respect of germination, control, and yield, even when containing only 18 per cent. metallic copper. The Karasch compounds A and B gave excellent results, reducing the amount of bunt to 0·86 and 0·1 per cent., respectively, but these products are not supplied on a commercial basis. Five of the eight Dupont dusts, Bayer No. 3, corona 640-S, and nickel carbonate were also fairly satisfactory. Immersion in copper sulphate (1 in 10) controlled the disease (0·55 per cent. infection) but reduced germination and yield. Formaldehyde completely eliminated infection but reduced germination in the field from 62 to 40 per cent.

Complete control of covered smut on Tennessee Winter barley was effected by one hour's immersion in 0·3 per cent. germisan, while uspulun and semesan at the same strength reduced infection to a trace. Half an hour's immersion in 0·3 per cent. formalin also gave good control, but reduced field germination from 78 to 64 per cent. Corona 640-S, copper sulphate (2·4 per cent., ten minutes' immersion), and 0·5 per cent. colloidal sulphur were unsatisfactory, and one hour's immersion of the seed in tap water increased the amount of smut from 8 to 15 per cent.

Similar results were obtained with Aurora oats. Both germisan

and uspulun controlled the smuts perfectly, while semesan reduced infection from 9 to 0·07 per cent. Formalin gave good control but caused a decrease in field germination from 85 to 68 per cent. One hour's immersion in 0·5 per cent. colloidal sulphur and six minutes in copper sulphate reduced the amount of smut to 0·7 and 0·3 per cent., respectively. Corona 640-S again proved ineffective, and soaking in water increased infection from 8 or 10 to 12 per cent.

RUMP (L.). **Studien über den Gerstenhartbrand (Ustilago hordei Kell. u. Sw.).** [Studies on covered smut of Barley (*Ustilago hordei* Kell. & Sw.).]—*Forsch. auf dem Gebiet der Pflanzenkrank. u. der Immunität im Pflanzenreich*, ii, pp. 21–76, 5 pl., 8 figs., 1 graph, 1926.

In this paper the author discusses in considerable detail the morphology, physiology, and mode of infection of covered smut of barley (*Ustilago hordei*).

Cytological investigations showed that conjugation between the cells of the promycelium occurs only under certain unfavourable conditions. Under suitable cultural conditions, e. g., on 0·5 per cent. cane sugar solution, barley straw decoction, or malt agar, conjugation occurs between the sporidia.

The dark brown chlamydospores from an immature ear of barley produced a distorted promycelium in 48 hours, while spores from a ripe ear germinated in half the time. The light brown and hyaline spores failed to germinate. The promycelia developing from the young spores produced no sporidia, but it is evident from these experiments that no resting period is required to induce germination in the chlamydospores.

Chlamydospores were found to be viable after five years in one experiment, but no definite data on viability were obtained. The sporidia lost their viability in seven weeks on malt agar under optimum cultural conditions, but retained it when kept in a damp chamber for four to seven months.

The results of experiments on the resistance of spores to high temperatures are fully described and are presented in tabular form. In a dry atmosphere a temperature of 60° C. killed over 50 per cent. of the spores in 15 minutes and all but 2 per cent. in five hours. After one hour at 75° only 5 per cent. of the spores germinated. Only isolated individuals could withstand a temperature of 100°, and at 150° the death of all the spores generally occurs in 5 minutes. In a saturated atmosphere, exposure at 100° for 5 minutes reduced the germination to 10 per cent., whilst 10 minutes sufficed to kill all the spores. Immersion in water at 52° to 53° for 5 minutes permitted 2·5 per cent. germination, whilst 10 minutes' treatment destroyed the spores. After 48 hours' exposure to a temperature of −17° in ice, 49·4 per cent. of the spores were still viable. The minimum, optimum, and maximum temperatures for the growth of *U. hordei* were determined as 5° to 6°, 20°, and 34° to 35°, respectively.

The nature and intensity of illumination appeared to be without influence on the development of the fungus.

Oxygen was found to be essential to the life of the organism and germination was stimulated in an extreme degree by its presence

in a pure form. In the absence of oxygen, or in cultures with an excess of carbonic acid, the sporidia gave rise only to mycelium and produced no fresh sporidia.

The results of experiments to ascertain the effect of the physical constitution of the soil on the germinability of the spores denoted that germination is most profuse in soil with a water content of 20 per cent. Cultural experiments showed that an acid medium is injurious to the development of the fungus, while an alkaline reaction (N/250 NaOH) stimulated germination. The best media for reproductive development are those containing carbohydrates, while vegetative growth is stimulated by nitrogenous substances.

Chlamydospores, which germinated normally, were artificially obtained on agar media prepared with biomalt.

In 1922 the writer infected barley seedlings by inoculating them between the glumes with sporidia or by covering the seed grains with a mixture of spores and soil. The germ-tubes of the sporidia penetrate the cells of the cotyledon, probably by the secretion of hydrolysing substances. About a fortnight after infection, the mycelium reaches the primary node, and may be observed in the intercellular spaces of the parenchymatous tissue, from which it travels upwards to the primordium of the ear some 20 days later. The ear tissue is ultimately destroyed and the cell contents and finally the cell walls absorbed. Fructification may occur also in the nodal tissues.

The disease was absolutely controlled by Sch 614 (Höchst Farbwerke), applied at the rate of 300 gm. per doppel-zentner [= nearly 2 cwt.], and by 30 minutes' immersion in 0·5 per cent. germisan or uspulun, 0·25 per cent. germisan, and 0·2 per cent. tillantin B. Half-an-hour's immersion in 0·25 per cent. uspulun reduced infection from 21·9 to 0·4 per cent., and one hour's steeping in 0·5 per cent. segetan-neu lowered the incidence to 3·3 per cent. Germisan dust M 50 per cent. and Merck dust (500 gm. per doppel-zentner) reduced the amount of smut to 6·2 and 6·6 per cent., respectively.

Overgaard (P. O.). **Gule pletter i Bygmarkerne.** [Yellow patches in Barley fields.]—*Ugeskr. for Landmaend*, lxxi, 21, p. 329, 1926.

Many complaints were received from various quarters of Denmark during the spring of 1926 as to the prevalence of the so-called 'yellow patch' disease of barley, which is characterized by a wilting of the uppermost 0·5 to 2 cm. of the leaf apex and is stated to be distinct from yellow tip and light speck [see this *Review*, v, p. 17]. The disturbance is believed to be due to shortage of potash fertilizers, especially on farms with little or no live-stock, where nitrogen and phosphoric acid are extensively used. The only cure for the disease appears to be the application of liquid manure.

Valleau (W. D.) & Johnson (E. M.). **A method of growing Corn seedlings (Zea mays) free from seed-borne organisms.**—*Journ. Agric. Res.*, xxxii, 12, pp. 1195–1198, 3 figs., 1926.

The following method was developed in order to obtain maize seedlings completely free from seed-borne organisms for use in determining the pathogenicity of organisms associated with maize

seeds and root rots. Seeds are soaked in a mixture consisting of 1 part CaO to 4 parts of water for about 20 hours and then immersed for 15 minutes in a 1 in 1,000 solution of mercuric chloride. After washing in sterile water, they are placed on agar in culture dishes for germination. When the radicle is about half an inch long and the paired seminal roots are just developing, these are cut off close to the seed, which is then transferred to a tube containing about 10 c.c. of nutrient agar. When fresh roots have arisen from the epicotyl or first node, the seedling is removed from the tube and, if it shows no sign of fungous infection, the seed is severed from the plant, thus leaving the seedling with a fairly well-developed root system, but minus the seed and any fungi which it may harbour. The seedling is then ready to transfer into sand or soil cultures, where it should be shaded for about 2 or 3 days until well established.

CHRISTENSEN (J. J.). **The relation of soil temperature and soil moisture to the development of head smut of Sorghum.**—*Phytopath.*, xvi, 5, pp. 353–357, 1 graph, 1926.

In 1924 and 1925 the author conducted a series of experiments in constant temperature tanks, fitted with an electrical apparatus enclosed in waterproof brass containers, to ascertain the effect of soil temperature and soil moisture on the incidence of head smut of sorghum (*Sorosporium reilianum*). In 1924 the temperature range was 16° to 34°, and in 1925 12° to 36° C. In the latter test the moisture content of the soil on an oven dry basis was 15 per cent. in half the cans in each of the tanks, and 25 per cent. in the other half. Smut spores and cultures of *S. reilianum* were thoroughly mixed with the soil.

Sorghum seedlings became infected at temperatures from 16° to 36°, the highest percentage of smut (38·35 and 46·50 in 1924 and 1925, respectively) occurring at 28°. The lower soil moisture was much more favourable to infection than the higher, no smut developing at 16° under the latter conditions and comparatively little at higher temperatures. The thermal range for infection coincides fairly closely with that for the optimum development of the pathogen in culture as determined by Potter (*Journ. Agric. Res.*, ii, p. 339, 1914), namely, 28° to 30°.

There was no correlation between the rate of germination of the sorghum seed and the percentage of smut which developed. Germination was most rapid at 34° to 36°, while the plants grew best at 28° to 36°. These data are thought to indicate that soil temperature and soil moisture determine the amount of smut by direct action on the pathogen rather than by indirect influence on the host.

A low percentage of infection appears to be associated with low temperature and high precipitation. In Minnesota the optimum temperature for spore germination, sporidial production, and seedling infection seldom occurs at planting time.

SHARPLES (A.). **Diseases of Coconut palms.**—*Malayan Agric. Journ.*, xiv, 3, pp. 65–73 ; 4, pp. 91–95, 1926.

The first of these two papers gives a brief survey of investigations

made in the West Indies and the Philippines on the cause of bud rot of coco-nut palms, followed by extracts from McRae's report on the operations in India to control the spread of this disease on Palmyra palms [*Borassus flabellifer*: see this *Review*, iii, p. 270]. *Phytophthora palmivora* is definitely regarded as the primary factor in the epidemic, the author's earlier criticisms [see this *Review*, i, p. 172] being fully met. He is, however, fairly satisfied that most of the so-called bud rot in Malaya can be ascribed to agencies other than attacks by *P. palmivora*, as is demonstrated clearly on mature African oil palms, which are frequently infected with a form of bud rot, but practically always recover.

The second article deals chiefly with two obscure diseases observed in Malaya which have been confused with bud rot by planters.

The first was encountered in 1921 on an estate in the Bernam River district, where cases of so-called 'bud rot' were frequent on trees suffering from attacks of white ants. The stem tissues were coloured a deep salmon pink with patches of mustard yellow intermingled. The discoloration travelled slowly up the stem from the roots, and bud rot was only found in advanced cases when practically the whole of the stem tissues at the base were involved. The central leaves were attacked last, occasionally the middle one remaining stiff and upright whilst the outer leaves had all collapsed, in marked contrast with the true bud rot [*P. palmivora*]. Similar symptoms without the presence of white ants were found on another estate later, and since 1922 the disease has been reported from almost every coco-nut district of Malaya. No mycelium could be found in the diseased tissue, whilst isolations usually yielded a white glistening bacterium which, however, has given no results on inoculation. Numerous vesicles which were always present in the cells were shown to be some form of tannin, laid down in response to wounding. The symptoms recall the red ring disease described by Nowell, but differ in the discoloration of the stem being invariably central, the absence of nematodes, and the nuts not falling prematurely.

A disease of very similar external appearance affecting trees upwards of twenty years old, is characterized by an abnormal lignification of the stem tissues. The leaves become smaller and the crown sparse and weak. The wood is discoloured a dull red with the vascular bundles showing up as dull brownish-red streaks. When a tree is cut the wood is found to be excessively hard and the tissue left uncut as the tree falls stands up like a stiff brush, owing to the tearing out of the abnormally lignified vascular bundles. The disease progresses slowly, but is extremely destructive and is widespread throughout Malaya.

[The first of these papers is reprinted in *Trop. Agriculturist*, lxvi, 6, pp. 342–349, 1926.]

TEODORO (N. G.). **Coconut diseases and their control.**—*Philipp. Agric. Rev.*, xviii, 4, pp. 585–592, 5 pl., 1925. [Received July, 1926.]

This circular [No. 179 of the Bureau of Agriculture] describes in popular terms the causes, distribution, symptoms, and control of the following diseases of the coco-nut prevalent in the Philippine Islands.

Stem bleeding disease (*Thielaviopsis*) [*paradoxa*]; bud rot (*Phytophthora faberi*) [*P. palmivora*]; nut discoloration (*Phytophthora* sp.); splitting and gumming of the husk, resembling a disease caused by *Colletotrichum* sp. in Kenya Colony; leaf spot (*Pestalozzia palmarum*); sooty mould (*Capnodium footii*); and two non-parasitic diseases, one characterized by a narrowing of the trunk immediately below the young leaves, and the other by a wrinkling of the leaves, probably caused by malnutrition.

NANNIZZI (A.). **Osservazioni sul dimorfismo degli elementi riproduttori agamici in un nuovo Diplosporium (D. vaginae sp. n.) ed in altri generi di Hyphales.** [Observations on the dimorphism of the asexual reproductive organs in a new *Diplosporium* (*D. vaginae* sp. n.) and in other genera of Hyphales.]—*Atti R. Accad. Fisiocritici Siena*, Ser. IX, xvii, 7–8, pp. 491–499, 1 fig., 1926.

In July, 1925, an investigation was made of a new species of *Diplosporium* (*D. vaginae*), which is stated to be characterized by two types of fructification of diverse origin, namely, conidia and aleuriospores. The former, borne on simple conidiophores measuring 50 to 80 by 2·5 to 3 μ, are oblong-elliptical, hyaline, uniseptate, and 15 to 20 μ in length by 5 to 6 μ in width; the latter, borne on fertile hyphae, are sessile or pedunculate, hyaline, and composed of two to six irregularly grouped cells, measuring 10 to 12 μ in diameter, with a thick, echinulate wall, and coarsely granular contents. The conidia germinate in five to six hours on Pollacci's medium at room temperature. Spherical, terminal, or intercalary chlamydospores occur singly or in groups in the mycelium.

The taxonomy of the fungus, and of a number of other Hyphomycetes, is discussed at some length on the basis of Vuillemin's classification (*Bull. Soc. Sci. Nancy*, Sér. III, xi, 1910; xii, 1911), and the work of various investigators in this field is cited and summarized. *D. vaginae* [a Latin diagnosis of which is given] closely resembles *Stephanoma strigosum* in its pluricellular aleuriospores, but differs from the latter in its septate conidia and non-verticillate conidiophores. There is further an analogy with *Lachnidium acridiorum* in the grouping of the aleuriospores, but the conidia of the latter fungus have three or more septa. *D. vaginae* is in certain respects allied also to *Sarcinella heterospora*, which is, however, characterized by a dematiaceous mycelium with fuliginous chlamydospores and aleuriospores and hyaline conidia with three transverse septa.

MOTTA (R.). **Contributo allo studio delle micosi del condotto uditivo esterno.** [Contribution to the study of the mycoses of the external auditory canal.]—*Atti R. Acad. Fisiocritici Siena*, Ser. IX, xvii, 7–8, pp. 603–631, 9 figs., 1926.

Clinical details are given of eight cases of mycosis of the external auditory canal, with notes on the cultural and morphological characters of the associated fungi.

The development of the organisms was frequently accompanied by conspicuous symptoms of inflammation, discharge, purulent secretions, and the like. As a rule, infection originated in the

superficial strata of the epidermis, spreading to the middle ear and sometimes causing perforation of the tympanum.

The following fungi were isolated from the affected region and cultured on a variety of artificial media: *Aspergillopsis nigra* [? *Aspergillus niger*], *Lichtheimia corymbifera* [*Absidia lichtheimi*], *Sterigmatocystis veneta* [*A. venetus*] (variety), *Penicillium crustaceum*, *P. bicolor*, *P. epigaeum* (variety), *Alternaria tenuis*, and a saccharomycete. This is stated to be the first record of *A. venetus* and *P. epigaeum* on man, and of *A. tenuis* in the ear.

A bibliography of over sixty titles is appended.

Motta (R.). **Nuova specie di Cryptococcus isolata dalla gola (Cryptococcus uvae, Pollacci et Nannizzi).** [New species of *Cryptococcus* isolated from the throat (*Cryptococcus uvae* Pollacci et Nannizzi).]—*Atti R. Acad. Fisiocritici Siena*, Ser. IX, xvii, 7–8, pp. 633–637, 1 pl., 1926.

In August, 1925, the writer isolated from the throat of a young male patient a fungus identified by Pollacci and Nannizzi as a new species of *Cryptococcus*, to which the name *C. uvae* has been given. The clinical symptoms caused by the fungus, together with its morphological and cultural characters, are described and a Latin diagnosis given.

Motta (R.). **Considerazioni su due casi di micosi delle fauci.** [Observations on two cases of mycosis of the fauces.]—*Atti R. Accad. Fisiocritici Siena*, Ser. IX, xvii, 7–8, pp. 639–654, 4 figs., 1926.

The clinical symptoms of two cases of mycosis of the throat are described, with notes on the morphological and cultural characters of the causal organisms.

The first case, diagnosed as benign tonsillar mycosis, was characterized by swelling and elongation of the uvula and by the presence, round the tonsillar region and at the base of the tongue, of greyish, slightly protuberant, smooth, elastic, ovoid-elongated bodies, about the size of a grain of wheat.

A fungus was isolated from the affected region and cultivated on a variety of media. Oval and spherical cells measuring 9 to 15 by 6 to 12 and 10 to 12 μ, respectively, were first observed, and these gave rise to hyphae which were simple or branched, with elongated cylindrical cells, 18 to 30 μ in length, terminating in a chain of ovoid cells. Sometimes the apical cell had thick walls, double membranes, and densely granular protoplasm suggestive of a chlamydospore. The organism was identified as *Monilia tumefaciens alba* (Foulerton) Ota. Notes are given on previous reports of similar cases.

The second case, diagnosed as thrush (stomatitis), was characterized by a reddening of the mucous membrane of the throat and by a milk-white incrustation of the tonsillar region. The fungus isolated from the affected part developed, on Pollacci's medium, spherical or oval cells, measuring 4 to 9, or 7 to 9 by 5 to 8 μ, from which two forms of hyphae may develop; one short, articulate, about 3 μ in breadth, and the other much elongated, undulating, branched, septate, and 2·5 μ broad. The organism was identified as *Crypto-*

coccus laryngitidis Sartory, Petges, and Claouè, the medical history and taxonomy of which is discussed, while a bibliography of over forty titles is appended.

FALCHI (G.). **Onicomicosi da 'Hemispora stellata'.** [Onychomycosis from *Hemispora stellata.*]—*Giorn. Ital. Dermat.*, ii, 9 pp., 1925. [Abs. in *Bull. Inst. Pasteur*, xxiv, 9, p. 401, 1926.]

Hemispora stellata was isolated from a lesion in a patient's thumb-nail, in which it produced a very slender, multiseptate mycelium, devoid of conidia. This mould is stated to have been reported as a human parasite in some ten cases, but the present is believed to be the first record of its association with onychomycosis.

CHYURLIA (N.). **Notes on a case of bronchomycosis.**—*Journ. Trop. Med. & Hygiene,* xxix, 10, pp. 145–146, 1926.

From the sputum of a patient aged 42, who had suffered since childhood from chronic bronchitis, a blastomycete, composed of numerous ovoid to ellipsoid bodies measuring 3 to 4 by 5 to 7 μ, was consistently isolated at about 40 examinations between 1922 and 1924. The organism was identified by Castellani as *Monilia krusei.* The symptoms have been alleviated by the use of a special auto-vaccine, iodide injections, and the application of ultra-violet rays.

WACHOWIAK (M.) & FLEISHER (M. S.). **Epidermomycosis of the sole caused by Monilia and yeast.**—*Arch. of Dermatology,* xiii, 6, pp. 815–818, 1926.

Pure cultures of two similar but not identical yeast-like organisms were obtained from small vesicles, 1 to 1·5 mm. in diameter, on the sole of the foot of two patients. The first organism was generally spherical, 3 to 6 μ in diameter, staining with difficulty, reproducing uniformly by budding (on Sabouraud's maltose agar), and fermenting none of the carbohydrates tested for the production of acid and gas. These scanty data do not permit of a specific classification of the organism, which is provisionally placed in the genus *Cryptococcus.*

The second organism showed a markedly stronger tendency than the foregoing to the production of oval forms. Reproduction usually occurred by budding, but a few mycelial elements appeared in the culture and spherical conidia were produced at the septa in the form of a rosette. Multiplication of these by budding *in situ* ensued until the mycelium was entirely hidden by clusters of conidia. This organism, which is regarded as a typical *Monilia,* fermented dextrose and maltose with the production of acid and gas.

NAOUMOFF (N. A.) Новости местной микофлоры. [Novelties of the local mycoflora.]—*Микология* [*Mycology*], Leningrad, i, 16 pp., 1 pl., 15 figs., 1926.

In the present note descriptions are given [with Latin diagnoses] of two new genera and twelve new species of fungi, for the most part parasitic, which were recorded in the government of Leningrad

in the course of the last ten to fifteen years. The following is of phytopathological interest.

Flax [*Linum usitatissimum*] in some years is extensively attacked by *Mycosphaerella linicola*, *Phoma linicola*, and *Ascochyta linicola*, usually all three species in association. The first appears in the form of isolated, submerged perithecia, about 200 μ in diameter, on the stems, which it does not appear to injure to any great extent. *Phoma linicola* forms on the middle and apical portions of the stems (which are neither killed nor discoloured) isolated, subepidermal pycnidia, about 150 μ in diameter, with a dark wall, containing one-celled, hyaline, elliptical spores, 10 to 13·4 by 3·3 to 5 μ. *Ascochyta linicola* Naoumoff & Vassilievsky, which in the earlier stages of the author's observations was frequently confused with the foregoing, forms at the base of the stems densely gregarious, brown, spherical or ellipsoidal, applanate, subepidermal pycnidia, from 110 to 160 μ in diameter. Its spores are two-celled (when young frequently one-celled) and measure 5 to 7 by 2 to 2·5 μ; collections made late in the season gave over 50 per cent. of the spores measuring up to 11 by 2·6 μ. The stems attacked show a brown discoloration at the base, which gradually extends far beyond the region occupied by the pycnidia, the plant being finally killed by the disease.

MELCHERS (L. E.). **Botrytis blossom blight and leaf spot of Geranium, and its relation to the grey mold of Head Lettuce.**—*Journ. Agric. Res.*, xxxii, 9, pp. 883–894, 3 pl. (1 col.), 1926.

In 1916 an outbreak of blossom blight and leaf spot occurred among geraniums (*Pelargonium hortorum*) in the greenhouses at Kansas State Agricultural College. The first symptom of disease was the premature fading and drying of the flower petals which, falling on to the leaves, caused infection in the shape of rather large, circular brown spots. In a moist atmosphere these spots enlarged, sometimes covering almost the entire leaf.

The microscopical and macroscopical characters of the causal fungus closely resembled those of *Botrytis cinerea*, and the fact that grey mould of head lettuce, known to be due to this fungus, occurred in adjacent greenhouses, supported this view, which was confirmed by the positive results obtained by inoculation experiments from infected lettuce plants to geraniums.

Proper watering and ventilation together with care in avoiding the accumulation of refuse are recommended as control measures.

VAN SLOGTEREN (E.). **Een en ander over het geelziek der Hyacinthen (Pseudomonas hyacinthi) en zijn bestrijding.** [Notes on the yellow rot of Hyacinths (*Pseudomonas hyacinthi*) and its control.]—Reprinted from *Weekblad voor Bloembollencultuur*, 31 pp., 8th, 11th, and 15th September, 1925. [Received July, 1926.]

The origin, symptoms, and mode of infection of yellow rot of hyacinths (*Pseudomonas hyacinthi*) [see this *Review*, iv, p. 544] are described, with a discussion of the various factors (meteorological conditions, varietal susceptibility, and the like) influencing

the course of the disease in Holland. Instructions are also given for the control of the disease by the protracted maintenance of the optimum temperature for the growth of the parasite (28° to 30° C.), in order to recognize and dispose of badly infected bulbs, followed by a rise, during the period from late August to the end of September, to 34° to 47·5°, the maximum for development and death-point, respectively, of *Ps. hyacinthi.* Preliminary experiments in the control of the disease by immersion of the bulbs in water heated to 47·5° or above for varying periods gave promising results.

VAN SLOGTEREN (E.). **De toepassing van warmte bij de bestrijding van bloembollenziekten en den invloed hiervan op den bloei der gewassen.** [The application of heat in the control of flower bulb diseases and the influence of this method on the quality of the resulting blooms.]—Reprinted from *Handelingen XXe Nederl. Natuur- en Geneeskundig Congres*, 4 pp., 1925. [Received July, 1926.]

This paper contains condensed instructions for testing for the control of yellow rot of hyacinths (*Pseudomonas hyacinthi*) the exposure of the bulbs to temperatures of 47·5° C. (118° F.) or above [see preceding abstract].

VAN SLOGTEREN (E.). **Bestrijding te velde van het geelziek der Hyacinthen.** [Field control of the yellow rot of Hyacinths.] —*Meded. Leden Vereen. 'De Hyacinth' (Haarlem)*, 7 pp., 1926.

Instructions are given for the reduction of the incidence of yellow rot of hyacinths (*Pseudomonas hyacinthi*) [see preceding abstracts] in the Dutch bulb-growing areas by strict attention to such cultural measures as the early separation of diseased or suspected from healthy individuals, the former being covered in the soil by inverted flower-pots; the screening of infected plots to prevent the spread of the organisms and to protect the plants from wind and other injuries; and care in all cutting operations and general field sanitation.

PAPE (H.). **Befall von Iris durch den Pilz Sclerotinia sclerotiorum.** [Infection of *Iris* by the fungus *Sclerotinia sclerotiorum.*]—*Gartenwelt*, xxx, 21, pp. 326–327, 3 figs., 1926.

In 1925 the writer investigated a disease, hitherto apparently undescribed, which occurred near Cologne on *Iris germanica* and *I. pumila*. A brown discoloration of the leaf apices was followed by the shrinkage and desiccation of the entire leaves. The leaf bases and root stocks, which were evidently the seat of infection, were covered with a white, flocculent mycelium, beneath which the tissue was disintegrated and rotting. Remarkable features of the disease were its suddenness and intensity.

The black, spherical sclerotia of *Sclerotinia sclerotiorum*, measuring 0·5 to 2 cm. in diameter, were found in the affected tissues, and the apothecial stage was successfully developed by leaving them for about two months on damp moss. Directions are given for the control of the disease by cultural measures.

FLACHS. **Septoria azaleae, eine gef hrliche Azaleenkrankheit.** [*Septoria azaleae*, a dangerous Azalea disease.]—*Blumen- und Pflanzenbau*, xli, 11, pp. 166–167, 3 figs., 1926.

In January, 1926, a severe attack of the leaf disease due to *Septoria azaleae* [see this *Review*, v, p. 367] occurred on two early azalea varieties, Madame Petrick and Madame Aug. van Damme, in a large nursery garden at Munich. Six hundred of the 2,000 plants were so badly damaged that they were quite unsaleable, and a heavy loss was incurred in consequence. Both varieties originated in Belgium, and on subsequent inquiry it was ascertained that the disease occurred also in two other nurseries supplied by the same firm. In some cases *Botrytis cinerea* was observed as a secondary parasite attacking the flowers of affected plants. The pycnidia of *S. azaleae* were found chiefly immersed in the tissues of the upper side of the leaf. The conidia, which were more or less curved, measured 15 to 20 by 2·5 μ and had one or two septa. The fungus was previously recorded in 1908 in Lower Silesia.

VAN HALL (C. J. J.) & SCHWARZ (M. BEATRICE). **Het bacterie-rot van de Orchideën.** [The bacterial rot of Orchids.]—*Indische Culturen (Teysmannia)*, xi, 9, pp. 240–241, 1926.

Orchids sent to Java from the Philippines and India have been observed to suffer from a wet rot of the leaves, which may begin either at the tip or at the base and is accompanied by a putrid odour. The affected tissues first assume a yellowish or grey discoloration and finally present a completely translucent appearance. Diseased leaves are readily detachable and the petioles shrivel at the point of attachment to the stem. In contrast to the *Phytophthora* rot, this disease does not appear to spread to the rest of the plant and its effects are therefore much less serious.

Microscopic examination of the affected tissues disclosed the presence of motile, rod-shaped bacteria in all the leaf cells except those of the epidermis and vascular bundles. On potato-glucose agar the bacterium formed semi-spherical, milk-white, mucilaginous colonies, sometimes with a distinct yellow centre. In a few days a blue-black, sometimes reddish coloration developed on this medium but not on others. Spore formation was not observed. The organism was found to be Gram-negative, capable of liquefying gelatine, and a facultative anaerobe.

Inoculation experiments on *Phalaenopsis amabilis* gave uniformly successful results on wounded leaves. *P. schilleriana* and *Vanda* sp. were also susceptible, while the leathery foliage of *Arachnis flos-aëris* proved highly resistant and a species of *Eria* succumbed only very slowly. Tomatoes, radishes, cucumbers, and onions were also infected by puncture inoculations.

The virulence of the cultures was found to be maintained after several months.

PICKETT (W. F.) & WILLIAMS (L. C.). **Spraying fruit plants.**—*Kansas Agric. Exper. Stat. Circ.* 125, 15 pp., 3 figs., 1926.

Brief popular notes are given on the chief insect pests and fungous diseases of fruit in Kansas, with directions for their control by the application of regular spraying schedules. Instruc-

tions are given for the preparation and use of some standard insecticides and fungicides.

GUBA (E. F.). **Apple blotch and its treatment.**—*Amer. Fruit Grower*, xlvi, 2, pp. 4, 51, 3 figs., 1 map, 1926.

A brief popular account is given of the origin, distribution, mode of infection, and control of apple blotch (*Phyllosticta solitaria*) [see this *Review*, iv, p. 743]. In addition to the usual spraying schedule, a delayed dormant application of 1 in 8 (or stronger) lime-sulphur or of copper sulphate (1 lb. in 10 galls.) is recommended in badly cankered orchards.

SCHNEIDERHAN (F. J.) & FROMME (F. D.). **Apple scab and its control in Virginia.**—*Virginia Agric. Exper. Stat. Bull.* 236, 29 pp., 7 figs., 1924. [Received August, 1926.]

Studies of apple scab (*Venturia inaequalis*) pursued at Winchester, Frederick County, Virginia, during 1922–3 showed that the discharge of ascospores from fallen, overwintered leaves occurs during or immediately after rain [see this *Review*, iv, p. 674]. Infection may or may not result from these discharges, according to the type of weather prevailing at the time and to the stage of development of the host. Favourable conditions for infection are muggy weather with little drying of foliage and fruit for some hours after ejection. On the other hand, a marked drop in humidity, involving rapid desiccation, is unfavourable to infection.

The period of ascospore discharge in 1922 extended from 18th April to 12th June, during which period ejection occurred on 16 separate days. In 1923 there were 13 discharges between 28th April and 30th July. The heaviest discharge in both seasons occurred during the middle of May. The most important ejections are those occurring just before, during, and shortly after blossoming [see also this *Review*, iii, p. 458].

A severe epidemic of scab, causing approximately 31 per cent. wastage of fruit, occurred in 1922 as a result of the wet season, while under the dry conditions of 1923 infection amounted to only 7·6 per cent. on unsprayed trees compared with 98·4 per cent. in the former year.

Very satisfactory control of scab was obtained on the susceptible Winesap, Rome, and Stayman varieties in 1922 with lime-sulphur and Bordeaux mixture. Seven applications were given, namely, delayed dormant, pink, calyx, two weeks, five weeks, ten weeks, and August. Lime-sulphur 1 in 8 was used for the first application, 1 in 40 for the second, third, and fourth, and 4–5–50 Bordeaux mixture with lead arsenate for the remainder. The percentages of scabby apples on four plots thus treated were 4·9, 7·5, 8·1, and 12·5, while the corresponding figures on the control plots were 76, 97·3, 98·4, and 97. The pink, calyx, and two weeks sprays were found to be the most important, their efficiency being estimated at 50, 25, and 15 per cent., respectively. The delayed dormant and five weeks applications were of little value (10 per cent. together), and the ten weeks and August sprays superfluous as regards scab, though useful against insects.

SCHNEIDERHAN (F. J.). **Apple disease studies in Northern Virginia.**—*Virginia Agric. Exper. Stat. Bull.* 245, 35 pp., 5 figs., 1926.

Observations have been made since 1921 on the prevalence of the more important fungous diseases of apples in Virginia in relation to weather conditions.

The May rainfall is stated to be the most important factor in the development of scab [*Venturia inaequalis*: see preceding abstract], four cycles of which were recorded in 1924, culminating on 30th May, 19th June, 1st July, and 1st October. In severe scab seasons, even the normally resistant York variety may be affected to the extent of 60 per cent. The relative control values of the different sprays have been determined as follows: pink, 40 per cent.; petal fall, 40 per cent.; ten days, 10 per cent.; and all others, 10 per cent.

Cedar rust [*Gymnosporangium juniperi-virginianae*] has consistently refused to yield to spraying treatment. Spore dispersal occurred over a period of 82 days in 1925 (from 2nd April to 23rd June). Infection is closely correlated with rainfall in the early growing months. In 1925 a safe distance between cedar and apple trees was approximately two miles, but this might not be sufficient in an epidemic season.

Blotch [*Phyllosticta solitaria*] usually appears on the fruit about 25 days after infection by the spores which exude from overwintered cankers in the spring. In 1925 there were seven such exudations, namely, on 24th May, 7th, 18th, 23rd, and 24th June, and 4th and 15th July. The ten days spray nullified 14·3 per cent. of these exudations, the five weeks spray 57·1 per cent., and the eight weeks application 28·6 per cent. In a plot receiving all three applications there were 95·9 per cent. healthy fruit compared with 34·2 per cent. on the control plot. Two distinct blotch cycles were recorded in 1925, on 12th June and 28th July, the latter being the more important. A satisfactory programme for blotch control in Virginia is lime-sulphur (summer strength) for the ten days spray, and Bordeaux mixture (3–5–50) for the later applications.

In the case of bitter rot [*Glomerella cingulata*] there were seven spore emissions between 14th June and 21st July, 1925. In addition to the destruction of diseased material, three applications of Bordeaux mixture, beginning with the five weeks spray, should be given.

Spray injury is reported to cause an annual loss of 3 per cent. of the Virginia apple crop. In experimental work, Bordeaux mixture caused severe russeting at 51° [F.], while lime-sulphur produced the most serious damage at 94°.

HAASE. **Der Stand der Süsskirschenerkrankung durch die Blattbräune in Oberbaden.** [The position of the leaf scorch disease of sweet Cherries in Upper Baden.]—*Obst- und Gemüsebau*, lxxii, 10, pp. 152–153, 1926.

The leaf scorch disease of sweet cherries [*Prunus avium*] caused by *Gnomonia erythrostoma* [see this *Review*, iv, p. 618] again assumed an alarming character in Baden during 1925. The trees which suffered from the disease in the previous year developed late

and showed symptoms of debility, which were followed towards the end of June by a severe attack of leaf scorch. The simultaneous development of *Phyllosticta prunicola* resulted in premature defoliation, which to some extent counteracted the effects of leaf scorch, since the fallen leaves decayed during the winter and consequently could not act as sources of fresh spring infection. The harvest, however, was almost a total failure. One attempt to control the disease by the application of Bordeaux mixture was successful in saving the crop.

SCHNEIDERHAN (F. J.) & HURT (R. H.). **The dry-mix spray for Peaches.**—*Virginia Agric. Exper. Stat. Bull.* 239, 16 pp., 3 figs., 1925. [Received August, 1926.]

Dry-mix sulphur-lime [see this *Review*, v, p. 311] has been found to be the cheapest and safest summer spray material for peaches in Virginia. The results of spraying experiments [particulars of which are given] show that it is slightly more efficacious in the control of scab [*Cladosporium carpophilum*] and brown rot [*Sclerotinia cinerea*] than lime-sulphur, to which it is greatly superior in ease of preparation, adaptability for storage, and other advantages, whilst the cost of 200 galls. spray fluid, containing 32 lb. home-made dry-mix, was approximately 80 cents, compared with $1·16 for self-boiled lime-sulphur.

SMALL (T.). **A disease of the Strawberry plant.**—*Eleventh Ann. Rept. Cheshunt Exper. and Res. Stat., Hertfordshire, 1925*, p. 85, 1926.

Strawberry plants grown under glass are reported to have been attacked by a disease characterized by a blackening of the root and a dying-off of the outer leaves. Six different fungi were isolated, and inoculation studies showed that the causal fungus is probably a *Diplodina* which it is thought may prove to be a strain of *D. lycopersici*. Stem inoculations into tomato, tobacco, and cucumber plants have resulted in a collapse of the tissues resembling the effect of the tomato 'canker' caused by the latter fungus.

WOLF (F. A.). **Leaf scorch of Strawberries.**—*North Carolina Agric. Exper. Stat. Tech. Bull.* 28, 16 pp., 8 figs., 1926.

Since 1921, the writer has been engaged on a study of the leaf scorch disease of strawberries [*Diplocarpon earliana*: see this *Review*, iii, p. 589] in North Carolina. This disease, first observed in France in 1832 and now widely known on the Continent, as well as in Canada and Australia [see this *Review*, ii, p. 15; v, p. 489], appeared in New York in 1884 and is stated to have become prevalent in many parts of the United States. The symptoms produced by *D. earliana* [which are described] resemble those of *D. rosae*, but the two organisms are regarded as quite distinct; a full description is given of the morphology of the former.

In addition to strawberries (*Fragaria vesca*), *F. chileonensis*, *F. virginiana*, and *F. viridis* have been found susceptible. Besides the use of resistant varieties, e. g., Senator Dunlap, Aroma, Brandywine, and Doctor Burrill, the following control measures are advocated: immersion of plants in Bordeaux mixture and removal of

infected leaves before planting; frequent renewal of fields and destruction of diseased tops; and spraying with 4-4-50 Bordeaux mixture.

PLAKIDAS (A. G.). **Strawberry 'yellows', a degeneration disease of the Strawberry.**—*Phytopath.*, xvi, 6, pp. 423–426, 1 fig., 1926.

This is a fuller account of the obscure disease of strawberries occurring in the coastal regions of California, Oregon, and Washington than that already noticed [see this *Review*, v, p. 235]. In addition to the symptoms previously described, a premature reddening of the older leaves and the appearance of small red dots on the lobes of the margins of very young leaves are conspicuous features of the disease. Infection is transmitted through the runners, so that all daughter plants from diseased mother plants are diseased, and continue to produce infected progeny on any soil.

Experiments have shown that the red spider (*Tetranychus telarius*), adverse chemical conditions of the soil, and soil organisms may be eliminated as factors in the etiology of the disease. The results of tests [which are briefly described] on forty healthy plants of the Banner variety clearly showed that the disease is caused by a virus which is transmissible by the strawberry aphid (*Myzus fragaefolii*).

REINKING (O. A.). **Fusaria inoculation experiments. Relationship of various species of Fusaria to wilt and Colorado disease of Banana.**—*Phytopath.*, xvi, 6, pp. 371–392, 8 figs., 1926.

The results of an extensive investigation on the relation between species of *Fusarium* and the occurrence of wilt and Colorado disease of the banana in Honduras are fully described.

Only one distinct organism, *F. cubense*, was found to be directly associated with, and capable of producing the typical symptoms of wilt. Such closely related species as *F. oxysporum* var. *nicotianae*, *F. orthoceras*, and *F. orthoceras* var. *triseptatum*, all of which occur in diseased banana plantations, were found to bear no direct relation to the disease, although it is suggested that the connexion of the two last-named organisms with root troubles should be further investigated.

F. cubense is stated to be practically always distinguishable from related organisms, though in certain doubtful cases it may be necessary to perform inoculation experiments to differentiate a saprophytic form of the fungus, which may possibly occur in virgin soils, from the parasitic one. The latter is not present in virgin soils, and many years would probably elapse before the saprophytic strain could adopt a parasitic mode of existence. Further experimental evidence was obtained of the presence of the parasitic form of *F. cubense* in the soil.

F. moniliforme var. *subglutinans* and *F. moniliforme* var. *erumpens*, both quite generally found associated with living and decaying banana plants and frequently also with Colorado disease, were found to bear no relation to the latter, which may therefore be regarded as a disease produced by abnormal and poor cultural

conditions. The prevalence of these organisms in banana plantations suggests the desirability of keeping them under observation.

No direct connexion was found between banana diseases and the presence of *F. anthophilum* in decaying banana trash, and with that of the *Fusarium* stage of *Hypomyces ipomoeae* in the soil and on dead plants in banana plantations and forests.

JOHNSTON (J. R.). **Banana wilt disease on the Island of Singapore.**—*Phytopath.*, xvi, 5, pp. 369–370, 1926.

Dr. O. A. Reinking, of the United Fruit Company, states in correspondence that banana wilt (probably *Fusarium cubense*) was observed on the outskirts of the city of Singapore on 13th October, 1925. Typical mycelial strands were discerned in the xylem tissue. Cultures of the organism will be made at the first opportunity to ascertain its exact identity.

SERRANO (F. B.). **Banana diseases in the Philippines.**—*Philipp. Agric. Rev.*, xviii, 4, pp. 578–582, 3 pl., 1925. [Received July, 1926.]

A brief description is given in this circular [No. 176 of the Bureau of Agriculture] of the occurrence, symptoms, causes, and control of the following banana diseases common in the Philippine Islands: wilt (*Fusarium cubense*), heart rot (associated with *Fusarium* sp.), curly top or bunchy top, freckle (*Phoma musae*), anthracnose (*Gloeosporium musarum*), and leaf spot (*Mycosphaerella musae* and *Macrophoma musae*).

BARKER (H. D.). **Fruitlet black rot disease of Pineapple.**—*Phytopath.*, xvi, 5, pp. 359–363, 2 figs., 1926.

This is a fuller account of the pineapple disease at Cap Haitien, Haiti, already briefly noticed [see this *Review*, v, p. 538]. Dark brown or blackish spots were observed on the dry, rather hard tissue of affected fruitlets, the symptoms frequently extending from the placentae in dark, somewhat granular radiations. Some or all of the inner surfaces of the fruitlet may be affected or the entire fruitlet may be blackened and rotted. Occasionally the fibro-vascular bundles showed a distinct brown discoloration. The disease, which develops during ripening, produces no external symptoms, though in another similar (apparently undescribed) disturbance, an amber-like gum is exuded from the eye. Inoculations with a pale yellowish bacterium, with rugose colonies, which was isolated from affected material, produced the typical symptoms of the disease, with the addition of gummosis. The organism was recovered from the blackened tissue, the discoloured fibro-vascular bundles, and the gummy exudate.

FITCH (H. W.). **Revised method for the quantitative determination of sulfur fungicides on foliage.**—*Phytopath.*, xvi, 6, pp. 427–428, 1926.

Certain modifications in technique are recommended to ensure greater accuracy in the quantitative determination of sulphur fungicides on foliage by the writer's method [see this *Review*, iv, p. 684].

ANDERSON (O. G.). **Recent progress in spray equipment.**—*Amer. Fruit Grower*, xlvi, 2, pp. 5, 40, 1 fig., 1926.

Great progress is stated to have been made during the last few years in the improvement of spraying appliances in the United States. A large percentage of the sprayers in present use are constructed to deliver 12 to 14 galls. per minute at 300 lb. pressure. The uses of the gun are also better understood, the majority of growers choosing the $\frac{1}{8}$ and $\frac{9}{64}$ inch disk openings, delivering $5\frac{3}{4}$ to $6\frac{1}{2}$ galls. per minute. On the so-called 'heavy duty' apparatus of 25- to 30-gallon capacity, operated at 400 to 500 lb. pressure, larger openings are being used with good results. Tests have further shown that guns with standard size disks spray effectively to a height of 22 ft., and that disk nozzles on bamboo rods are equally efficacious. The system of installation of stationary spraying plants is described and some important factors in this connexion are briefly discussed [see also this *Review*, iv, p. 236]. The cost of the work is estimated at $75 to $175 per acre and the life of the stationary apparatus at five years longer than that of the portable outfit.

NIETHAMMER (ANNELIESE). **Ein Beitrag zur Samendesinfektion.** [A contribution to seed disinfection.]—*Biochem. Zeitschr.*, clxxii, 1–3, pp. 173–211, 1 diag., 1926.

The writer's experiments in the total sterilization of the seeds of a number of agricultural plants by chloride of lime and other preparations are described. The chemotherapeutical index was calculated, where practicable, on the lines of Gassner's method [see this *Review*, ii, pp. 554–557; iv, p. 231].

The index for chloride of lime (stock solution of 0·5 gm. in 100 c.c. tap water containing 0·18 per cent. titratable chloride, gradually diluted to 0.0225 per cent.; time of immersion, four hours) was found to be 0·25 for the complete sterilization of Postelberger wheat grain. This may be regarded as a very favourable figure, especially in view of the fact that protracted immersion (14 hours) caused no perceptible damage, though complete sterilization may be secured by two hours' treatment. Chloride of lime also gave good results with a number of other seeds. Thorough disinfection was also effected by three hours' immersion of wheat seed grain in a solution of 30 parts of sodium hypochloride in 100 c.c. water (0·5 per cent. titratable chloride). For potassium hypochloride (0·2 to 0·8 per cent. titratable chloride) the chemotherapeutical index was 1.

Some standard preparations as used for the control of wheat bunt (*Tilletia tritici*) were also tested. Tillantin (0·5 per cent.) was found unsatisfactory, the *dosis toxica* lying far below the *dosis curativa*. Only three of the six wheat samples were fully sterilized by three hours' immersion and the germinated wheat seedlings were incapable of forming rootlets.

Better results were given by 0·5 per cent. germisan, which completely sterilized all the samples of wheat and maize seed-grain submitted to six and four hours' treatment, respectively. With this compound, unlike most of those used in laboratory methods of seed disinfection, no preliminary rinsing of the seed in strong alcohol and then in soap solution was required.

The best results with uspulun were obtained by 14 hours' immer-

sion in solutions ranging from 0·125 to 0·5 per cent. The *dosis curativa* under these conditions was estimated at 0·125 and the *dosis toxica* (roughly) at the same figure, giving a chemotherapeutical index of 1, as in the case of potassium hypochloride. Uspulun is, however, greatly superior to the latter method since no preliminary treatment is required. Favourable results were also obtained with 0·5 per cent. uspulun on buckwheat (*Fagopyrum*: 1 hour and 20 minutes' immersion), maize, beans (*Phaseolus*), barley, and white lupin (all treated for four hours).

Kalimat was somewhat less satisfactory than germisan and considerably impaired germination.

TEODORO (N. G.). **Phytopathology: its fundamental principles.**—*Philipp. Agric. Rev.*, xviii, 4, pp. 325–371, 24 pl., 24 figs., 1925. [Received July, 1926.]

This paper, giving a general outline of the study of phytopathology, is written primarily for those desiring an introduction to the subject. It comprises sections on all the various agents of disease, their control, methods of research, and directions for sending diseased plants for diagnosis. The paper is copiously illustrated and a comprehensive bibliography appended.

ORTON (C. R.). **Seeds as carriers of disease.**—*Journ. New York Bot. Gard.*, xxvii, 315, pp. 54–63, 1926.

The author discusses the economic importance of seed-borne diseases in agriculture, and refers to his preliminary working list of 200 or more parasites known to be carried by seeds.

Data extracted from the *Plant Disease Reporter*, issued by the United States Department of Agriculture, are quoted to indicate the enormous annual loss incurred from plant diseases between 1918 and 1924. It is estimated that seed-borne parasites are responsible for annual losses amounting to 2·3, 3·1, 3·2, and 6·1 per cent. of the wheat, barley, oats, and bean crops, respectively. Many of the most destructive diseases are said to have been introduced from other countries on imported seed.

The advantages of the organic mercury compounds, which are regarded as the most effective seed disinfectants, are briefly summarized. They are stated to have been first developed and introduced by the Bayer Co. in 1912. Both uspulun (chlorphenolmercury compound) and Bayer compound and dust (nitrophenolmercury) have proved of high fungicidal value, but the low toxicity to plant tissues of the first is a distinct advantage. Tables are given from the writer's experiments to show the relative superiority of these over corrosive sublimate in increasing the yield of maize, and over copper carbonate dust with beans.

DUFRÉNOY (J.). **Méthodes biologiques de lutte contre les maladies des plantes.** [Biological methods of control of plant diseases.] —*Rev. Path. Comp. et Hyg. Gén.*, xxvi, 294, pp. 130–135, 3 figs., 1926.

The nature of susceptibility and resistance to fungous parasites is discussed in general terms, with special reference to the modifications induced by infection in the metabolism of the host, and the

chief biological methods of control are outlined and illustrated by well-known examples. These prophylactic measures include the pure line selection of resistant varieties, use of resistant stocks for grafting, crop rotation, destruction of alternate hosts, and utilization of hyperparasites and of secondary organisms to impede the development of the pathogens.

KÜSTER (E.). **Zur Aetiologie der Panaschierungen.** [Contribution to the etiology of variegations.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xxxvi, 5–6, pp. 129–142, 1926.

This is a critical review of the principal German and foreign literature on variegation in plants, which the writer in his 'Pathological Plant Anatomy' [see this *Review*, iv, p. 751] divides into two main categories, namely, (1) in which the mottled and normal green areas are imperceptibly merged, as in the case of infectious mottling of the Malvaceae, mosaic disease of various Solanaceae, and the like; and (2) characterized by a definite delimitation of the mottled and normal areas, represented, for instance, by striped grasses, &c. The rôle played by internal and external factors, soil composition, temperature, and other environmental conditions is discussed in the light of present knowledge, which the writer admits to be very far from complete.

YOUNG (P. A.). **Penetration phenomena and facultative parasitism in Alternaria, Diplodia, and other fungi.**—*Bot. Gaz.*, lxxxi, 3, pp. 258–279, 3 pl., 1926.

A series of investigations was carried out at Bozeman, Montana, on the penetration phenomena and experimental host ranges of many facultative parasites, when tested on the epidermis of the stems of aseptically grown seedlings, which were rolled in wet, autoclaved rags, and placed in tubes at 25° C. for 2 to 14 days after inoculation. The uninjured leaves of greenhouse plants were also inoculated and then covered with bell jars lined with wet filter paper and protected from the sun with sacks for three days.

All species of *Alternaria*, *Acrothecium*, and *Helminthosporium* placed on wheat coleoptiles caused the formation of callosities or thickenings of the cell walls, and most of them also produced a brown discoloration of the cells. On staining with acid fuchsin or Congo red, the epidermis near the points of incipient penetration is found to be greatly altered. Penetration hyphae enter the cuticle from the lower sides of the appressoria. The formation of callosities around these hyphae is a reaction of the cells to penetration. Each callosity encloses an infection hypha which appears as a prominent body resembling a brightly shining dot or an angularly irregular line which may project from the enveloping sheath and cross the neighbouring cells. The callosities formed by *Diplodia zeae* and *Cephalosporium acremonium* were smaller and narrower than those produced by *Alternaria*, but were very numerous. Internal hyphae were frequently observed to send batteries of penetration hyphae into adjacent cell walls, inducing the formation of numerous similar callosities.

The cell walls in the areas of penetration were much thickened and exhibited prominent middle lamellae. *Alternaria* species from

asparagus and rose produced hyphae in pockets in swollen vertical cell walls of wheat, and in general the penetration hyphae of *Alternaria* and other fungi usually entered vertical cell walls.

Yellow auto-stained disks were seen in the cell walls of one wheat coleoptile infected by *Alternaria,* and a grey auto-stained disk in a coleoptile invaded by *Acrothecium.* The red stained rings round the points of penetration by *Alternaria, Helminthosporium, Cephalosporium acremonium,* or *Colletotrichum nigrum* consist of four regions, viz., (1) the unstained callosity itself; (2) the adjacent region which is lightly or not at all stained (deeply in red disks); (3) a broad, red band surrounding the first two regions and forming the ring; and (4) the unstained, normal host cell walls beyond the ring.

Brown cells occur singly or in small groups in wheat coleoptiles infected with *Alternaria*; they may be macroscopically visible as brown streaks. The coleoptiles often become entirely brown and rotten, and bear aerial mycelium. *Helminthosporium* from barley produced new sporophores and spores on wheat coleoptiles within four days after inoculation.

The negative results of repeated inoculation experiments with broth filtrates in which *Alternaria* and *Helminthosporium* had grown and liquid pressed from *Alternaria* mycelium indicated that these penetration phenomena are not due to chemicals from the fungi.

Mechanical injury caused marked discoloration of the cells of wheat, sorghum, and broom corn (*Holcus* [*Andropogon*] *sorghum*); such discoloured regions, however, were deficient in callosities, auto-stained disks, red rings, and other penetration phenomena.

In *Acrothecium* and *Macrosporium cucumerinum* the penetration phenomena were similar to those caused by *Alternaria.*

The reactions of oats, rye, barley, and maize to penetration by *Alternaria* and *Helminthosporium* were similar to those of wheat. *C. acremonium* produced callosities and spots on maize leaves, the latter phenomenon being caused also by *M. cucumerinum, D. zeae,* six isolations of *Alternaria,* and two species of *Helminthosporium.* A deep, reddish-brown discoloration of the injured regions was observed in sorghum and broom corn infected by *Alternaria,* six species of which caused leaf spots and four produced callosities.

Cabbage, turnip, and radish seedlings were infected by different species of *Alternaria* from *Abutilon,* pepper (*Capsicum frutescens*), and wheat. Pumpkin (*Cucurbita pepo*) and melon seedlings developed callosities, sometimes accompanied by internal hyphae, on inoculation by various species of *Alternaria* (including those from *Abutilon* and gooseberry), two of *Helminthosporium,* and *D. zeae.* Soy-bean seedling stems infected with *Alternaria* exhibited yellow, disk-shaped aggregations of granules at the points of incipient infection. Stomatal penetration by *Alternaria* occurred in a pea leaf and a tomato stem. *Macrosporium iridis* and another species probably identical with *M. parasiticum* penetrated onion membranes by sending hyphae of normal diameter through greatly swollen vertical cell walls.

In addition to these examples, hundreds of other cross-inoculations were made, many of which (especially in the greenhouse tests) failed

to cause any infection phenomena. It is pointed out that the two hundred new diseases artificially produced appeared under conditions very different from those normally prevailing in the field.

WATERS (C. W.). **The reactions of Bean rust grown on leaves in solutions.**—*Papers Michigan Acad. of Science, Arts and Letters*, v, pp. 163–177, 8 figs., 1926.

The investigation reported in this paper was undertaken with a view to determining the physiological reactions of the bean rust, *Uromyces appendiculatus*, when grown on bean leaves or portions of leaves detached from the host and floated on solutions in Petri dishes.

The results of the inoculations showed that in all cases the pustules extended through the leaf, but first broke through the surface which had been exposed to the light. Leaves placed with the upper surface uppermost always showed a heavier infection than when the under surface was exposed, attributable to the greater amount of available food material in the palisade tissue of the upper surface of the bean leaf. The larger number of stomata on the under surface of the leaf should permit free penetration of the germ tubes, but shortage of food limits the development of the fungus in this case.

An increase in the hours of light was found to expedite sporulation; continuous lighting resulted in shortening the incubation period by 24 hours. There was a difference in the incubation period according as the leaves were floated on a 5 per cent. sucrose solution or on distilled water, amounting to one or two days, while plants inoculated in the greenhouse generally showed a longer incubation period than leaves in dishes. On leaves kept in the dark there was no infection when floated on distilled water, but infection was about normal on the sugar solution. On the latter the secondary uredosori nearly always form in concentric circles round the primary one, and in some cases tertiary sori encircle the secondary ones, while the teleutospores were formed without exception in the secondary or tertiary pustules and never in the primary pustules. On the other hand, on distilled water the teleutospores were found interspersed with the uredospores in the primary sori, and secondary sori were scarcely ever formed; the sori themselves were smaller than on sugar and the spores were less coloured, but their germination and virulence were unimpaired.

Further experiments suggested that the appearance of teleutospores bore a distinct relation to the nutrition of the fungus, the disappearance of food being apparently the signal for teleutospore formation.

TOCHINAI (Y.). **Comparative studies on the physiology of Fusarium lini and Colletotrichum lini.**—*Journ. Coll. of Agric., Hokkaido Imper. Univ.*, xiv, 4, pp. 171–236, 2 graphs, 1925. [Received July, 1926.]

The writer discusses at considerable length the physiology of nutrition and growth of *Fusarium lini* and *Colletotrichum lini*, the causal organisms, respectively, of wilt disease and anthracnose of flax [see this *Review*, iv, p. 219].

Maltose was found to be the most nutritious carbohydrate for both fungi, followed by fructose and sucrose for *F. lini* and by lactose, soluble starch, and glycogen for *C. lini.* Nitrogen was more readily assimilable in the ammonium form than in the nitrate, while the nitrite was entirely unsuitable for both organisms. Proteins were generally suitable as a source of nitrogen, though less assimilable than peptone. On the whole, the organic nitrogen compounds were more suitable than the inorganic nitrogen salts, the best nutrition being obtained by the use of peptones, polypeptides, or a proper combination of several amino-acids.

The hydrogen-ion concentration of the cultural solution plays an important part in the growth of the organisms, especially in the case of *C. lini*, which could not tolerate so wide a range of P_H as *F. lini.* The optimum concentration for the latter was about P_H 5 [see this *Review*, v, p. 441] and for the former P_H 6. *F. lini* lowered the hydrogen-ion concentration of the cultural solution when its initial value was above P_H 6·5, and caused the staled organic nitrate solution to remain alkaline, while *C. lini* did not produce this effect when the initial concentration was below P_H 4·5 and never turned the solution alkaline. The cell sap of normal flax seedlings is P_H 5·5 to 5·7, and it is thought that *F. lini* makes the sap more or less alkaline, while *C. lini* renders it acid.

The growth of *C. lini* was greatly retarded in a nutrient solution containing 0·05 per cent. tannic acid and entirely checked at 0·1 per cent., while *F. lini* was able to withstand concentrations over 1·3 per cent. *C. lini* was also very sensitive to the action of citric acid, mycelial development being arrested by a 0·5 per cent. concentration.

The temperature relations for the mycelial growth of the fungi were as follows: minimum for both nearly 10° C.; optimum for *F. lini* 28·5° to 29·5° and for *C. lini* 25°; and maximum for *F. lini* 37° and for *C. lini* 35°. *F. lini* was far more resistant to heat than *C. lini*, the former surviving four hours' exposure to a temperature of 50°, while the latter was killed within thirty minutes. The corresponding figures for 60° were three hours and ten minutes, respectively. Both organisms were fairly resistant to cold, exposure to −21° to −20° for 24 hours producing no ill effects.

The rapid wilting characteristic of plants attacked by *F. lini* is thought to be due to obstruction of the xylem consequent upon the production of gas, while the poisoning of the cells is caused by the alkalinity produced by the fungus. In the case of anthracnose, the gradual advance of the typical pathological symptoms and the appearance of spots may be explained by the decay of the tissues due to the direct enzymatic action of the mycelium; by the appropriation of part of the nutrient supply by the causal organism; and possibly by the death of the affected cells resulting from the increased hydrogen-ion concentration of the sap.

A bibliography of 120 titles is appended.

Barrus (M. F.) & Chupp (C.). **Potato diseases and their control.** —*Cornell Extens. Bull.* 135, 123 pp., 36 figs., 1926.

The following diseases of potatoes are described and in most cases illustrated, control measures being also indicated.

Mosaic; leaf roll; spindle tuber; yellow dwarf; streak; late blight (*Phytophthora infestans*); early blight (*Alternaria solani*); leaf blotch (*Cercospora concors*); *Rhizoctonia* (*Corticium vagum*) [*C. solani*]; wilt (*Fusarium oxysporum* and *Verticillium albo-atrum*); *Fusarium* wilt and tuber rot (*Fusarium eumartii*); brown rot (*Bacterium solanacearum*); blackleg (*Bacillus atrosepticus*); common scab (*Actinomyces scabies*); powdery scab (*Spongospora subterranea*); silver scurf (*Spondylocladium atrovirens*); wart disease (*Synchytrium endobioticum*); storage dry rots caused by *Fusarium* spp.; and various physiological disturbances, including tipburn, frost necrosis, net necrosis, and blackheart.

The bulletin further contains much useful information on seed and soil treatments; roguing; storage conditions; and the preparation and application of sprays and dusts used as fungicides. With reference to dusting, some injury has been reported on potato foliage from the use of a 20–80 copper sulphate-lime dust mixture when used immediately after mixing. This is prevented by keeping in tight containers for two weeks prior to application, and the injury is negligible with freshly mixed dust containing not more than 15 per cent. copper sulphate.

WERNER (H. O.). **The spindle-tuber disease as a factor in Seed-Potato production.**—*Nebraska Agric. Exper. Stat. Res. Bull.* 32, 128 pp., 18 figs., 16 graphs, 1926.

Since 1922 much experimental work has been carried out at the Nebraska Agricultural Experiment Station on the spindle tuber disease of potatoes [see this *Review*, iii, pp. 296, 297], and the data obtained are presented in tabular form and discussed at some length in this paper.

Spindle tuber [the symptoms of which are described] has been proved to be responsible for much of the degeneracy of seed-potatoes formerly attributed to unfavourable environmental conditions. The disease has been found to a varying extent on the following important commercial varieties: Triumph, Early Ohio, Irish Cobbler, Downing (Early Idaho), Pearl, Rural New Yorker, Green Mountain, Russet Burbank, King, Peach Blow, Early Rose, Hebron, and Blue Victor. Infection occurred to a considerable extent in seed stocks from ten northern States.

The general low average yield of potatoes per acre in the irrigated regions of western Nebraska is ascribed to the prevalence of spindle tuber, which has also been the leading factor in the rejection of fields for certification during the past few seasons. Certified stock, however, is showing a consistent annual decrease in the incidence of the disease as the result of a general roguing and seed selection campaign.

In eastern Nebraska mulching with straw resulted in a reduction of the percentage of infected tubers in the progeny, whilst late planting (middle of May) was effective in reducing the incidence of the disease both in rogued and unrogued plots.

Spindle tuber was transmitted from diseased to normal stock by tuber grafts and by the alternation of healthy with infected plants. The progeny of such infected plants produced individuals equally

severely affected with the original diseased stock. Infection was transmitted in fields across a number of rows.

Infection occurred very early in 1923. Plants exposed only for ten days produced seriously diseased stock. In western Nebraska early harvesting was of little value as a means of escaping infection, but in the east of the State it was more effective.

The vector of spindle tuber has not been determined. Aphids occur in such negligible numbers in western Nebraska that they can hardly be responsible for more than a fraction of the damage.

The percentage of spindle tuber was found to increase so rapidly from year to year after initial infection that after two or three years the entire strain or lot was worthless for seed unless control measures were adopted. Seed selection of best type tubers from an infected lot was found to be useless in the maintenance of a strain, and the tuber-index method has not yet been proved effective in the control of the disease. It is hoped that a better knowledge of the symptoms manifested under winter greenhouse conditions may contribute to greater efficiency in the use of this latter method. The selection of a healthy strain and its subsequent cultivation in an isolated and severely rogued plot is the best method known at present for the control of spindle tuber.

[A popular edition of this paper is published as *Bulletin* 207 of the Nebraska Agricultural Experiment Station.]

Davis (W. B.). **Physiological investigation of black heart of Potato tuber.**—*Bot. Gaz.*, lxxxi, 3, pp. 323–338, 7 graphs, 1926.

A physiological investigation was conducted at Los Angeles, California, on black heart of the potato tuber [see this *Review*, iv, p. 238]. The disease was induced in the laboratory on Rural New Yorker potatoes at a temperature of 45° C., in a carbon-dioxide-free atmosphere with abundant available oxygen. By methods which are briefly described, the following determinations were made on the affected tissues over a period of about 16 hours: ratio of carbon dioxide to oxygen in the intercellular spaces, conductivity of the tissues, catalase activity, and H-ion concentration changes.

During the time preceding the development of black heart, carbon dioxide accumulates rapidly in the internal atmosphere and oxygen is correspondingly depleted, until the intercellular gases contain more than 50 per cent. of the former and less than 4 per cent. of the latter.

This first change in the internal environment of the cells is followed by increasing permeability of the protoplasm and death of the cells. At the temperatures used, the condition is apparently the result of high respiratory activity and the failure of the gas exchange to keep pace with the respiration rate, but the possible effects of temperature and other factors must be taken into consideration.

The catalase activity of the affected tissues does not seem to be correlated with respiratory activity.

A slight increase of the hydrogen-ion concentration was registered during the development of black heart, but the change was not localized and its significance is not apparent.

Temperature may exert a direct effect above 38°, this being

evidently the critical point for the maintenance of the normal water relations of the cells.

Colour changes similar to, or identical with those produced in black heart may be caused by various methods, e.g., killing with the electric current, infection by *Phytophthora erythroseptica* or other pathogenic organisms, freezing injuries, and immersion in toluene or glycerine.

VAUGHAN (R. E.) & BRANN (J. W.). **Hot formaldehyde for Potato seed treatment.**—*Wisconsin Agric. Exper. Stat. Circ.* 202, 8 pp., 3 figs., 1 diag., 1926.

Full directions are given for the control of black scurf (*Rhizoctonia*) [*solani*], scab [*Actinomyces scabies*], and blackleg [*Bacillus atrosepticus*] on potatoes by $2\frac{1}{2}$ minutes' immersion in hot formaldehyde solution at a strength of 1 pint in 15 galls. of water heated to 125° F. [see also this *Review*, v, p. 149]. Three different methods of applying the treatment, namely, by direct steam, by steam coils, and by a mechanical process, are briefly explained.

Some statistics relating to the use of the treatment at various experiment stations are given. In one instance the amount of scab was reduced from 61 to 4 per cent., and in another from 24 to 4 per cent. (as against 6 per cent. with corrosive sublimate). In a three-year test in Kansas, treated seed gave an increase in yield of 41·6 bushels per acre over untreated. It is estimated that the amount spent in California on corrosive sublimate in 1924 was $7,000, while 50,000 bushels of potatoes were treated with hot formaldehyde in the same State in 1925.

NEUWEILER (E.). **Das Auftreten des Kartoffelkrebses in der Schweiz im Jahre 1925.** [The occurrence of wart disease of Potatoes in Switzerland in the year 1925.]—*Landw. Jahrb. der Schweiz*, xl, 2, pp. 283–285, 1 map, 1926.

A brief account is given of the discovery and distribution of wart disease of potatoes (*Synchytrium endobioticum*) in Switzerland in 1925 [see this *Review*, v, p. 124], and of the legislative measures which have been adopted to prevent its further spread. Infection is stated to have originated in a consignment of Kaiserkrone potatoes from Mannheim [Baden]. In addition to the first centre of infection near Basel, the disease was subsequently detected in eight parishes in the canton of Lucerne and one in that of Aargau, while a number of localities in Zürich and Zug are under suspicion. All these places were supplied with potatoes from Mannheim. In October the disease was also observed in an isolated area on the old Red Diamond variety which had been cultivated for ten years without any trace of infection.

VAN EVERDINGEN (E.). **Het verband tusschen de weergesteldheid en de Aardappelziekte (Phytophthora infestans).** [The relation between weather conditions and Potato blight (*Phytophthora infestans*).]—*Tijdschr. over Plantenziekten*, xxxii, 5, pp. 129–140, 1926. [English summary.]

With reference to the negative results obtained by Miss Löhnis in her investigation of the relation between meteorological con-

ditions and potato blight (*Phytophthora infestans*) [see this *Review*, iv, p. 761], the writer points out that insufficient attention was paid to the combined influence of several factors operating simultaneously. As shown by Roussakov [see this *Review*, iii, p. 387], the occurrence of night dews is an important factor in the development of fungous diseases. The four requisite conditions for the development of late blight are stated to be: (1) night temperature below the dew point for at least four hours; (2) minimum temperature of 10° C. or above; (3) mean cloudiness the next day 0·8 or above; and (4) rainfall during the next 24 hours of at least 0·1 mm. Among the 30 dates of outbreak of blight during 1919 to 1923, 29 were preceded within 15 days by a day fulfilling the four conditions, and after 1st May only five such days occurred which were not followed by infection within 15 days.

Certain discrepancies in the data relating to the incubation period of the disease are discussed, and proposals are made to supplement the available evidence by providing for meteorological observations on potato fields, and by the application of control measures only after days fulfilling all the above-mentioned conditions.

WOLLENWEBER (H. W.). **Kartoffelfäule und Vorratsschutz.** [Decay of Potatoes and the protection of supplies.]—*Mitt. Gesellsch. Vorratsschutz*, ii, 3, pp. 32–37, 1926.

Brief, popular notes are given on various types of storage rot of potato tubers, including black heart [see above, p. 626]; infection caused by bacteria and fungi, comprising *Hypochnus* [*Corticium*] *solani*, *Spondylocladium atrovirens*, *Actinomyces* [*scabies*], *Spongospora subterranea*, *Synchytrium endobioticum*, *Fusarium* spp., and *Phytophthora infestans*; and pathological conditions associated with an unfavourable environment. Concise instructions are given for the application of preventive measures, and suggestions are made for the utilization of unsaleable stocks (1,500,000 tons per annum) as fodder, starch products, or raw material for distillation purposes, in Germany.

HARTER (L. L.), WEIMER (J. L.), & LAURITZEN (J. I.). **The comparative susceptibility of Sweet Potato varieties to black rot.**—*Journ. Agric. Res.*, xxxii, 12, pp. 1135–1142, 1926.

In the course of 4 years' experiments (1921 to 1924 inclusive) 21 varieties of sweet potatoes were tested under field conditions at Rosslyn, Virginia, for resistance to black rot (*Ceratostomella fimbriata*) which is widely prevalent in the United States. The results of the investigations indicated that no variety is immune from black rot either in the seed-bed, in the field, or in storage, and a variety slightly affected one year may be badly diseased the next.

It was noted that although diseased plants were set in the field, the percentage of black rot among the potatoes when dug was comparatively small, even in cases where they actually grew on diseased plants. In storage, however, at a temperature of about 25° C. and a relative humidity of from 84 to 86 per cent., the disease spread rapidly, even the most popular varieties, e.g., Porto

Rico and Nancy Hall, developing large, conspicuous lesions which measured up to 3 inches.

STOUGHTON-HARRIS (R. H.). **Oidium leaf-fall of Rubber.**—*First Quart. Circ. for 1925, Rubber Res. Scheme (Ceylon)*, pp. 8–9, 2 figs., 1925. [Received July, 1926.]

A brief description is given of the symptoms and life-history of *Oidium* [*heveae*], which caused an outbreak of abnormal leaf fall on rubber trees in the Kalutara district of Ceylon at the end of February, 1925, following several heavy falls of rain [see this *Review*, iv, p. 633; v, pp. 517, 580].

Young leaves of trees which wintered rather late showed a crinkling of the edges and rumpling of the whole surface. In most cases the blade of the leaflet dies back to about a third of its length, starting from the apex, which curls up and becomes dry, brown, and brittle. The affected leaves drop in succession, a typical feature of diseased trees being the numbers of petioles bearing only one or two leaflets instead of three. On older leaves the attack is usually confined to the leaf edges, which become distorted and crinkled. Owing probably to the thickness of the cuticle, the only effect produced on still older foliage is the appearance of yellowish, translucent spots with a thin coating of superficial mycelium.

The barrel-shaped spores of the fungus measure 28 to 42 by 14 to 23 μ and are usually borne singly at the end of short stalks. Occasionally two spores may be found on the same stalk, or the basal cell may be sterile. In germination the single germ-tube occasionally develops a vesicle from which new branches arise, whilst in rare cases the spores divide before germination, and a germ-tube is given off from each daughter cell.

SHARPLES (A.). **Hevea mildew in Ceylon and Malaya.**—*Malayan Agric. Journ.*, xiv, 4, pp. 88–90, 1926.

The author quotes *in extenso* the recent article by C. H. Gadd on the occurrence of *Hevea* mildew (*Oidium*) [*heveae*] in Ceylon [see this *Review*, v, p. 517], and states that with the exception of unimportant details, the symptoms correspond closely with those of a 'leaf fall' which was reported from widely separated districts in Malaya during 1925. Examination of the attacked leaves showed, however, that the disease in Malaya was due to a totally different organism, the prominent fungus being a species of *Gloeosporium*, probably *G. albo-rubrum*. There were no signs of *Phytophthora* hyphae in the tissues nor of *Oidium* on the surface of the leaves, which invariably turned black at the infected regions.

Up to the time of writing not a single case of 'leaf fall' has been reported in 1926, a state of affairs which is attributed to the dry climatic conditions during the unfolding of the new leaves.

TAYLOR (R. A.). **Observations on the amount of nitrogen lost by trees as a result of Phytophthora attack.**—*Second Quart. Circ. for 1925, Rubber Res. Scheme (Ceylon)*, pp. 7–8, 1925. [Received July, 1926.]

Analysis of fallen rubber leaves attacked by *Phytophthora*

[? *meadii*] at the Culloden Estate, Neboda, Ceylon, showed that the nitrogen content was only 2·16 per cent. compared with 3·15 per cent. in normal foliage. It is pointed out that in addition to the loss of foodstuffs incidental to leaf fall, the whole metabolism of the affected trees becomes disorganized, while the development of new foliage which the tree has to produce entails the utilization of any available reserves.

ASHPLANT (H.). **Circulars of the Rubber Specialist. No. 1. The spraying of Rubber.**—*Planters' Chron.*, xxi, 17, pp. 270–273, 1926.

The efficiency of the spraying lances and nozzles used ordinarily on rubber plantations in India is criticized on account of the serious loss of time involved in adjusting the nozzle for distance variations.

In 1925, an improved type of spray gun was devised by Messrs. Drake and Fletcher [Kentish Engineering Works, Maidstone, England], which has the advantage of being easily adaptable to any length required, whilst the type of spray can be regulated by a handle near the operator's hand. This 'Armada Gun' is 8 ft. long, with a 4 ft. extension piece, and is considered to be a distinct advance in rubber spraying equipment, but the author suggests that a 10 ft. gun without an extension would probably be an improvement.

The advantages of fine spraying over coarse spraying are discussed and attention is drawn to the superior covering capacity and adhesiveness of the fine spray. The author recommends that the coarse sprays should only be used in cases of urgency.

STEINMANN (A.) & DEUSS (J. J. B.). **Over de toepassing van de in de Rubbercultuur gebruikelijke desinfectiemiddelen.** [On the application of the disinfectants generally used in Rubber cultivation.]—*Arch. Rubbercult. Nederl.-Indië,* x, 5, pp. 159–198, 1926. [English summary.]

The principal disinfectants used in the Dutch E. Indies on the tapped surface of rubber trees are described under three headings, namely, (*a*) tar preparations; (*b*) tar preparations not miscible with water; and (*c*) mixtures of tar with oil, resin, wax, or paraffin with benzine or spirit.

(*a*) The first category comprises the following preparations. Swedish or wood tar is stated to be unsuitable for the tapped surface on account of its lack of free carbon and excess of phenol and acetic acid. The so-called 'blasentar' contains 8 per cent. acetic acid and tar from resinous wood 12 per cent.

Coal-tar should satisfy the following requirements: freedom from excess of ammoniacal water and acids; above 50 per cent. solubility in benzol; homogeneity; viscosity of 57·7° E. and 120·7° E. at 50° C. and of 5·0° E. and 5·6° E. at 100°. This substance may be applied cold to the tapping surface provided a strip of 1 cm. be left free above the cut. It has the disadvantage, however, of concealing the surface, so that wounds, and the like, are readily overlooked.

Water-gas tar is a thin fluid which penetrates to a great depth and may be used as a substitute for carbolineum [see below].

Creosote must be free from naphthalene and its homologues and

contain 3 to 20 per cent. of phenols for the preservation of dead wood, while its specific gravity must be nearly equal to that of water (1·015, not above 1·07, at 38°). In order to produce a good emulsion the addition of resin soap is essential. A good preparation consists of 26 per cent. resin soap; 61 per cent. light creosote (sp. gr. 1·025, 18 per cent. phenol); 3 per cent. petroleum (sp. gr. 0·815); and 7·5 per cent. each of caustic soda and water. According to Schmitz and Zeller (*Indus. & Engin. Chem.*, xiii, p. 621, 1921), a creosote distilled at 270° to 315° C. is the most satisfactory for the destruction of fungi. Creosote varnishes with pitch or bitumen, and tars containing pitch or asphalt, are stated to crack rapidly.

Cambisan is an expensive neutral tar which is difficult to apply in a cold state on account of its thickness.

Directions are given for testing these mixtures. The tree should be pared in two places, (1) down to the hard bark containing stone cells, and (2) as far as the soft latex vessels. The bark should be examined for depth of penetration and other properties of the mixture ten days after application.

(*b*) Among the tar preparations not miscible with water which are in general use against mouldy rot [*Ceratostomella fimbriata*: see this *Review*, v, p. 325] and stripe canker [*Phytophthora faberi*] may be mentioned carbolineum, solignum, agrisol, and izal. Experiments with dougalite, noxonia, Jeyes' fluid, jodelite, morbifugo, diphenso, and pantox, have only just been initiated and no definite statement as to the value of these preparations can yet be made. The results of tests with 2 per cent. phenol soda, phenol (caustic) soda, phenol lime, phenol chalk, phenol NaOH, and phenol soda with chalk were not very promising.

Carbolineum is derived from coal distilled between 240° and 260°, vegetable oil, or filtered anthracene oil. It has a specific gravity of 1·12, boiling-point 230°, great viscosity, flash-point above 120°, and is free from naphthalene.

Good results in the control of stripe canker have been given by a mixture of one part of solignum and three parts of melted batik wax, heated over charcoal and smeared on the tapping surface.

(*c*) A satisfactory preparation consists of 18 l. of spirit, 1·5 l. creoline, and 6 kg. resin. The estimated price of this mixture is 37 cents [about 8 pence] per l. (sufficient for 300 trees), the treatment of one tree, therefore, costing only $\frac{1}{8}$ cent.

[An English translation of this paper appeared in *Trop. Agriculturist*, lxvii, 1, pp. 15–30, 1926.]

GIBSON (A. P.). **Bureau of Sugar Experiment Stations. Northern Field Assistant's Report.**—*Australian Sugar Journ.*, xviii, 1, pp. 54–56, 1926.

This report contains the following references of phytopathological interest. Leaf scald of sugar-cane [*Bacterium* sp.: see this *Review*, v, p. 327] was found to be very prevalent throughout the Hambledon and Mulgrave district [Queensland], especially on the N.G. 15 (Badila) and H.Q. 426 (Clark's Seedling) varieties. In isolated areas whole stools of plant cane were dying out as a result of this disease.

Leaf stripe [*Sclerospora sacchari*] was observed on the 7 R. 428

(Pompey) variety at Sawmill Pocket. Seed planted from this area perpetuated the disease.

A slight amount of mosaic was located on H. 109 at Aloomba.

Brown rot [see this *Review*, v, p. 385] was found on N.G. 15 growing on virgin scrub land on the Upper Mulgrave River. The same variety was slightly affected by top rot [see this *Review*, ii, p. 581] in the Gap.

A disease known as 'peg leg' was observed at Sawmill Pocket on the H.K. 426 variety. The few canes which make any growth run to a pencil point in the ground and stools are seldom formed.

COTTRELL-DORMER [W.]. **Bureau of Sugar Experiment Stations. Mosaic disease in Mackay areas.**—*Australian Sugar Journ.*, xviii, 1, pp. 53–54, 1926.

At a very conservative estimate, mosaic disease has probably increased by 300 per cent. in the Mackay areas [Queensland] during the last two years, and there is every prospect of a continued spread unless active steps are taken to check its advance. This may be largely effected by the removal of maize, sorghum, *Panicum colonum*, *P. sanguinale*, native sorghum (*Sorghum* sp.), *Setaria aurea*, and an unidentified grass known as cane grass from the vicinity of the cane fields [see this *Review*, iv, p. 568]. In one field where mosaic symptoms were found in *P. colonum*, 100 per cent. of the adjacent Clark's Seedling canes were diseased, while 60 per cent. of the stools growing within half a chain of the infected grass showed 5 to 10 per cent. mosaic. The corn aphis (*Aphis maidis*) was very plentiful on *P. colonum* and on sorghum growing close by.

KELLY (N. L.). **Bureau of Sugar Experiment Stations. Diseases in southern districts.**—*Australian Sugar Journ.*, xviii, 2, pp. 106–107, 1926.

The Q. 813, Malabar, N.G. 16, and H.Q. 285 varieties of sugarcane have been found resistant to gumming disease [*Bacterium vascularum*] in the Nambour district [Queensland], while the use of N.G. 15 [Badila], D. 1135, E.K., M. 1900 Seedling, Gingila, Innis 131, Gingor, and 7 R. 428 [Pompey] is not advocated under present conditions. Careful 'seed' selection, one of the principal control measures against gumming, is stated to be extremely difficult, except when the yellow streaks are in evidence and when the cane is more than $\frac{1}{4}$ mile from diseased stools.

Fiji disease [see this *Review*, iii, p. 606] is said to cause immensely heavy losses on the D. 1135 and Malabar varieties in the Beenleigh district of Queensland and on the Tweed, Richmond, and Clarence Rivers (New South Wales). No seed should be cut from diseased fields, and all fields showing more than 5 per cent. infection should be ploughed out after harvesting.

MURRAY (J. C.). **Bureau of Sugar Experiment Stations. Maryborough and Pialba districts.**—*Australian Sugar Journ.*, xviii, 2, pp. 109–110, 1926,

This report contains the following references to matters of phytopathological interest. Foot rot [? *Marasmius* sp., see this *Review*,

iv, p. 568] was prevalent on canes growing in badly drained patches along the banks of the Mary River [Queensland]. This disease and mosaic were also abundant in the Isis district, the former being apparently on the increase. Sorghum, maize, and other grasses are hosts of foot rot, while Johnson grass [*Sorghum halepensis*] suffers from a disease resembling mosaic.

GIBSON (A. P.). **Bureau of Sugar Experiment Stations. Tully and Babinda areas.**—*Australian Sugar Journ.*, xviii, 2, pp. 107–109, 1926.

This report contains the following references of phytopathological interest. On the whole the Tully and Babinda areas [Queensland] are fairly free from disease. Leaf scald [*Bacterium* sp.] killed many stools of newly planted N.G. 15 (Badila) cane. In the Babinda area the practice of growing sorghum next to cane fields is very prevalent and greatly assists the spread of mosaic, leaf stripe [*Sclerospora sacchari*], and leaf scald. Gumming disease [*Bacterium vascularum*] was detected in the comparatively new Waugh's Pocket area, where leaf scald was also very prevalent.

RANDS (R. D.). **Root disease of Sugar-cane in Louisiana.**—*U.S. Dept. of Agric. Circ.* 366, 19 pp., 6 figs., 1926.

In this paper an attempt has been made to outline the symptoms and effects of root disease of sugar-cane in Louisiana [see this *Review*, iv, p. 312], where it has been shown to be largely responsible for the serious reduction of yield observed in recent years.

The writer's prolonged studies on the etiology of the disease indicate that root mutilation by soil-inhabiting snails and other root-eating animals is of primary importance. The discovery of two species of centipedes involved in the causation of root rot is reported. Roots injured in this manner frequently reveal the presence, in a secondary capacity, of soil-infesting fungi, such as *Fusarium*, *Rhizoctonia*, *Marasmius*, *Sclerotium*, *Colletotrichum*, *Penicillium*, *Mucor*, and other moulds and bacteria.

Soil fumigation with paradichlorobenzene has had, in preliminary tests on young planted cane, a decidedly preventive effect both on root mutilation and subsequent rotting. Some degree of control may also be effected by the use of resistant varieties, e. g., several of the P.O.J. seedlings, and by the regular turning under of all cane trash with a view to improving the physical condition of heavy soils.

GADD (C. H.). **Branch canker of Tea.**—*Trop. Agriculturist*, lxvi, 4–5, pp. 272–276, 1926.

In this paper, the author enlarges on his note on branch canker of tea [see this *Review*, v, p. 521] and distinguishes clearly between the canker caused by *Macrophoma theicola* and the more common wood rot, a term which is applied to the large lesions, caused by various organisms, generally starting from a pruning cut.

Experiments have been carried out on several estates in an attempt to stop the progress of rot without necessitating the pruning of the affected branches. On side branches, after cutting out diseased material, protection can be secured by the application of

antiseptic coverings, such as tar. On the main stems cement and sand have been used successfully to fill the cavities left after removing diseased wood. The efficacy of this scraping and filling method depends almost entirely on the thoroughness with which the diseased material is removed from the wound. The removal of only obviously decayed tissues is insufficient. Though the thin, transparent hyphae are difficult to see, the fungus is present in the discoloured but still hard and unrotted wood, and the cleaning process must remove this. At present, scraping and filling is not recommended for adoption on a large scale in place of the pruning method of control.

SCHWARZ (M. BEATRICE). **Meeldauw van Tabak en Physalis minima.** [Mildew of Tobacco and *Physalis minima.*]—*Indische Culturen (Teysmannia)*, xi, 9, pp. 238–239, 1 graph, 1926.

Physalis minima, a widespread weed occurring throughout Java, was recently observed at the Buitenzorg Phytopathological Institute to be attacked by a mildew involving the whole stem and both leaf surfaces. In severe cases the leaves showed a mosaic discoloration in addition to the typical white powdery appearance.

A comparison of one hundred conidia of the fungus from diseased leaves with the same number of those of *Oidium tabaci* [? *Erysiphe cichoracearum*], the causal organism of tobacco mildew [see this *Review*, iv, p. 131], showed that the average dimensions of the former are 30·21 by 17·01 μ, with a ratio of length to width of 1·78, the corresponding figures for the latter being 31·70 by 16·19 and 1·96. The conidia of *O. tabaci* from the Vorstenland measured 31·18 by 15·16 μ with a length to width ratio of 2·05, showing the influence of climatic conditions on spore dimensions.

The identity of the organisms on *P. minima* and tobacco may be regarded as established by these investigations, and an explanation of the spread of tobacco mildew simultaneously provided.

CLARA (F. M.). **Diseases of Tobacco (Nicotiana tabacum L.) in the Philippines.**—*Philipp. Agric. Rev.*, xviii, 4, pp. 564–570, 3 pl., 1925. [Received July, 1926.]

The author describes in popular terms in this circular [No. 171 of the Bureau of Agriculture] the symptoms, causes, and control measures of the following diseases of tobacco in the Philippines: damping-off (*Pythium de Baryanum*, *Phytophthora nicotianae*, *Sclerotium rolfsii*, *Rhizoctonia* sp., and other fungi); bacterial wilt (*Bacterium solanacearum*); *Fusarium* wilt; root rot (*Thielavia basicola*); *Sclerotium* blight (*S. rolfsii*); leaf spot (*Cercospora nicotianae*); and mosaic.

WILLIAMS (P. H.). **Tomato leaf mould.**—*Eleventh Ann. Rept. Cheshunt Exper. and Res. Stat., Hertfordshire, 1925*, pp. 67–72, 1926.

Experiments with fungicides to control *Cladosporium fulvum* [see this *Review*, v, p. 257], the cause of leaf mould of tomatoes, showed that the fungus on an infected leaf was very hard to kill, owing to the difficulty of wetting the leaf, and also to the peculiar growth of the spore masses. The spores adhere together and the outermost tend to protect those within from the action of the fungicide.

Successful results were obtained from fumigation experiments on the destruction of the fungus at the end of the season with sulphur dioxide and with formaldehyde. The former appears to be effective at a concentration of about 1 per cent. (roughly equivalent to burning 2 lb. of sulphur per 1,000 cu. ft.), which is much less than the amount usually recommended.

WILLIAMS (P. H.). **Root rot of the Tomato caused by Thielavia basicola.**—*Eleventh Ann. Rept. Cheshunt Exper. and Res. Stat., Hertfordshire, 1925*, pp. 74–75, 1926.

From some wilted tomato plants, the roots of which were rotted and the stem tissues browned, *Thielavia basicola* was isolated in April, 1925. Inoculation of young tomato plants with pure cultures of the fungus at the end of November resulted in the reproduction of the disease. The fungus grows well on potato and Quaker oat agars but poorly on tomato agar and synthetic media. The optimum temperature for growth is about 25° C.

The same fungus was also found recently attacking French beans [*Phaseolus vulgaris*], and inoculations with it on this host were also successful.

SMALL (T.). **'Rhizoctonia foot-rot' of the Tomato.**—*Eleventh Ann. Rept. Cheshunt Exper. and Res. Stat., Hertfordshire, 1925*, pp. 76–85, 1926.

In this paper an account is given of investigations undertaken on account of the annual losses of Guernsey growers from epidemics of foot-rot disease of tomatoes, due to *Rhizoctonia solani.*

The fungus causes dry brown scars on the stem at soil level and sometimes wilting, whilst when the attack is severe the stem is encircled and the plant falls over. Complete control of the disease was obtained by steaming the soil for two hours or by baking for one hour at 200° to 205° F.

Of several fungicides tested, only heavy applications of the following compounds were effective in checking the disease: formaldehyde, phenol, potassium dichlorcresylate, potassium dichlorphenate, ammonium carbonate, and ammonium hydroxide.

Atmospheric temperatures from 58·7° to 67·3° resulted in heavy infection. Above 72°, providing the soil was fairly dry, the severity of the attack diminished, and above 80° little infection resulted, even when the soil was very moist. Experiments showed in every case that the disease is worst in a wet soil, and that a warm, dry soil acts as an effective check. Slaked lime, potassic and phosphatic fertilizers had no beneficial effect. Sterilized stable manure, applied at the rate of 30 tons per acre, aggravated the disease. Eight varieties were tested for resistance to the disease and all were found to be equally susceptible.

CARNE (W. M.). **Black spot or blossom-end rot of Tomatoes.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., iii, 1, pp. 21–22, 1 fig., 1926.

Blossom-end rot of tomatoes, which occurs every summer in Western Australia, has caused considerable damage this year, following the hot, dry period in January. The actual cause of the disease is unknown, but it is considered to be closely connected with

deficiency in soil moisture, occasioned by irregular watering or by dry winds in very hot weather.

Very little can be done to control the disease, but either of the following treatments may be given: (1) keeping the plants continuously supplied with ample moisture, always avoiding excess, and mulching with well-rotted stable manure, especially on light sandy soils; or (2) avoiding the forcing of plants which come into bearing in January or February, so that they may become accustomed to relatively dry conditions.

VANTERPOOL (T.). **Streak or winter blight of Tomato in Quebec.** *Phytopath.*, xvi, 5, pp. 311–331, 3 figs., 1926.

This paper gives a further account of the author's work on streak or winter blight of tomato in Quebec [see this *Review*, v, p. 195]. The author considers that the Australian spotted wilt [ibid., p. 213] is probably the same disease, as is also the winter blight of the United States [ibid., p. 333]. Successful inoculations were secured by any method in which the extracted juice of diseased plants was brought into contact with that of healthy plants, the incubation period on young plants in the field being 12 days under ordinary summer conditions. All parts of the plant tested were found to contain infective juice, but the roots have not yet been examined.

Filtration of the juice through Chamberland F filters did not destroy its virulence, and it is considered to be definitely established that the disease belongs to the filterable-virus group. Heating the juice to 70° C. for 10 minutes did not render it inactive, but drying for two months did. The virus was shown to withstand a 1 to 800 solution of corrosive sublimate for 2·5 hours and 1 to 1,000 for 48 hours. Seed transmission was not found to occur, but aphids were proved to carry infection. High temperature and humidity increase the rapidity with which the symptoms develop. Inoculated on healthy tobacco the virus produced a very severe type of mosaic, and when a combination of potato and tomato mosaic viruses were inoculated into tomato the symptoms produced were identical with those here described as streak. The latter is, therefore, thought to be a mixed infection, as suggested by Dickson [see this *Review*, v, p. 195].

WILSON (M.) & WALDIE (J. S. L.). **Rhizosphaera kalkhoffii Bubák as a cause of defoliation of conifers.**—*Trans. Roy. Scot. Arbor. Soc.*, xl, 1, pp. 34–36, 2 pl., 1926.

The defoliation of spruce trees, especially *Picea pungens* var. *argentea* and *P. sitchensis*, has been observed since November, 1922, to be frequently associated in Great Britain and Ireland with the presence of a species of *Rhizosphaera* which was subsequently detected also on *P. excelsa*, *P. nigra*, *P. alba*, *P. orientalis*, *P. schrenkiana*, *Abies pectinata*, *A. nobilis*, *Pseudotsuga douglasii* [*P. taxifolia*], *Pinus austriaca*, and *P. montana*.

The first symptoms of the disease appear in May, on current year's needles, which assume a purplish-brown tint. Sections through affected needles reveal a profuse hyaline mycelium in the mesophyll. The hyphae are from 2 to 4 μ in thickness, branched, with fairly numerous septa, and occur both in the intercellular spaces and in the cell cavities. Pycnidia are formed by the out-

growth of a dense mass of pale brown, thick-walled hyphae through the stomatal opening. The hyphae are preceded by a small mass of white, waxy material, soluble in alcohol, which normally obstructs the stomatal aperture and which can easily be seen on the surface of the pycnidium, serving as a useful distinguishing character for the genus *Rhizosphaera*. On entering the stomatal aperture the few hyphae passing through the guard cells spread out like a fan and appear to be continuous with the pycnidial wall, which consists of a single layer of dark cells. The long rows of pycnidia corresponding with the stomatal arrangement on the needles of spruces and silver firs are very characteristic of the fungus.

Mature pycnidia are ovoid to spherical, tapering somewhat abruptly into the stalk-like basal portion, with a dull black, roughened wall; they measure 80 to 150 μ in diameter. At this stage the waxy mass on the apex has disappeared, but no definite ostiole is seen, the pycnidium apparently rupturing irregularly at the apex to liberate the unicellular, hyaline, eguttulate, ovoid spores, measuring 7 to 10 by 3 to 4 μ.

R. kalkhoffii, with which the species under discussion is considered identical, was first described in Germany on *Picea pungens* var. *argentea* in 1914 (*Ber. Deutsch. Bot. Gesellsch.*, xxxii, p. 188). *R. abietis*, recorded on *A. pectinata* in France in 1907 (*Bull. Soc. Myc. France*, xxiii, p. 53), differs in its larger spores, and is not known to occur on this host in Great Britain.

R. kalkhoffii appears to be most abundant on the glaucous varieties of *P. pungens*, extensively cultivated as ornamental trees, on which it causes extensive defoliation, sometimes resulting in death, especially with 14- to 20-year-old individuals. It has also been found attacking nursery stock of *P. sitchensis* and *P. excelsa*. On both these hosts the presence of the fungus is usually associated with that of *Aphis abietina*, so there is some difficulty in estimating the amount of damage caused by the respective organisms.

It is considered probable that the fungus was introduced into Britain with consignments of young plants of *P. pungens* from the Continent.

WILSON (M.) & WILSON (MARY J. F.). **Rhabdocline pseudotsugae Syd.: a new disease of the Douglas Fir in Scotland.**—*Trans. Roy. Scot. Arbor. Soc.*, xl, 1, pp. 37–40, 2 pl., 1926.

Since 1922 a serious defoliation of 15-year-old trees of two varieties of the Douglas fir, namely, the blue (*Pseudotsuga glauca*) and the inter-mountain or dry belt (*P. douglasii* [*P. taxifolia*] var. *caesia*), has been caused in the south of Scotland by *Rhabdocline pseudotsugae* [see this *Review*, iv, p. 526].

The fungus produces purplish-brown patches on the leaves of the former host, giving a mottled appearance to the tree. On the latter the attack is more serious, the whole needle usually becoming discoloured and the defoliation being very extensive. The diseased leaves are abnormally thin, and the mycelium excessively profuse, although fructifications are not as well developed as on *P. glauca*. Hence the blue Douglas, though less severely attacked, is likely to prove the more serious source of infection. Inoculation experiments on *P. glauca* and the green Douglas (*P. douglasii*) [*P. taxifolia*] have so far given negative results, though in America both varieties

and all intermediate forms are attacked. The existence of biologic forms of the fungus in that country, differing from any present in Britain, is therefore suspected.

R. pseudotsugae, which was described by Sydow in 1922 (*Ann. Mycol.*, xx, pp. 194, 215), produces in the leaf a mycelium composed of hyaline, septate hyphae, measuring 2·5 to 5 μ in thickness, which do not pass back into the shoot. The infected cells die, their contents turn brown, and a marked decrease occurs in their starch reserves. About March the hyphae increase towards the lower surface of the leaf, just below the two bands of stomata. The brown, elongated apothecia subsequently formed at this point have a hyaline basal layer, 40 to 65 μ in thickness, and open by a longitudinal slit in the epidermis, disclosing the orange hymenium consisting of cylindrical asci with very short stalks, measuring 115 to 125 by 17 to 21 μ, and paraphyses. The eight cylindrical ascospores are usually slightly constricted in the middle and measure 17 to 21 by 7 to 10 μ. When ejected from the ascus the majority of the spores are unicellular and surrounded by a thick layer of mucilage, but rapidly become bicellular. The normal method of germination appears to consist of the production of a germ-tube by one of the cells.

The ascospores are mature by the middle of May and the young leaves are infected just as they are opening. In America conidia are developed on these leaves about July. After the ascospores have been shed the leaves drop from the tree, without the formation of an absciss layer. Spraying with a solution of soap and 4–4–50 Bordeaux mixture is reported to have given good control of the disease in American nurseries. Seedlings have not yet been attacked in Britain.

Infection has recently been discovered on a group of *P. glauca* about eight miles north-east of the first location, the spores having been apparently carried by the prevailing south-westerly winds.

This is believed to be the first record of *R. pseudotsugae* in Europe, and it emphasizes the risk of introducing plants from abroad without careful examination by trained mycologists.

Salmon (E. S.) & Ware (W. M.). **The 'downy mildew' or 'spike disease' of the Hop in 1925.**—*Journ. Min. Agric.*, xxxiii, 2, pp. 149–161, 4 pl., 1926.

The authors' further experience in 1925 indicates that the recently reported epidemic of downy mildew of the hop (*Pseudoperonospora humuli*) in the south of England [see this *Review*, iv, p. 767] may cause far greater injury than was thought at first. Serious damage was caused by the cessation of growth in June of a considerable proportion of the bines in certain gardens, owing to the formation of 'spiked' growths at their tips. On removing these infected spikes it was found possible in many cases to train up a healthy lateral shoot from lower down to replace the spiked one.

Serious damage to the hop-cones was observed in two gardens, in which the cones were turned brown by the attack of the mildew.

Outbreaks were also reported during 1925 in France, Belgium, Russia, Czecho-Slovakia, and Germany, and the authors are now inclined to think that the fungus may have been introduced into

Europe within recent years from Japan or the United States. The suggestion made earlier [see this *Review*, iv, p. 703] that the downy mildew [*Pseudoperonospora urticae*] of nettles (*Urtica dioica* and *U. urens*), a species very closely resembling *P. humuli*, has become capable of attacking the hop, has not been confirmed by recent inoculation tests.

Hop mildew produces its summer spores as early as April on spike-like basal shoots, which may be distinguished by their silvery-grey or greyish-green colour and rigidity. From these sources the leaves of healthy bines in the neighbourhood become infected. The mycelium overwinters in the underground portions of the plant and apparently develops with the annual shoots, causing these spiked growths. Oospores have been found in the tissues of the spikes and also in the bracts and bracteoles of infected cones.

The systematic and prompt destruction of the 'spikes' is essential if the disease is to be effectively controlled, and it is also necessary to remove and destroy infected cones, as these are liable to harbour winter spores. As soon as possible after hop-picking all the bines in infected gardens should be burnt. Wild hops should be eradicated from the vicinity of the gardens.

TUBEUF (C. v.). **Blasenrost der Weymouthskiefer. (Richtigstellung.)** [Blister rust of the Weymouth Pine. (Correction.)]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz*, xxxvi, 5–6, pp. 143–146, 1926.

In connexion with the statement made in a previous paper [see this *Review*, v, p. 260] that *Pinus peuce* is susceptible to blister rust [*Cronartium ribicola*], the writer has since ascertained that this is not the case. The supposed *P. peuce* seedlings attacked in the Grafrath experimental garden were really *P. monticola*. It is believed that *P. lambertiana*, which was stated by Klebahn to be susceptible, may also have been confused with *P. monticola*. This species, however, together with *P. aristata-balfouriana* (once found infected) and the apparently immune *P. excelsa*, is not adapted to the German climate, except possibly in exceptionally mild situations.

MERINO (G.), TEODORO (N. G.), & OTANES (F. Q.). **The Philippine Plant Quarantine Service.**—*Philipp. Agric. Rev.*, xviii, 4, pp. 411–461, 5 pl., 1925. [Received July, 1926.]

A compilation is given of all the legislation at present in force in the Philippine Islands for the protection of cultivated plants against invasion of new pests and diseases from abroad, and for combating those already existing in the country. The organization of the Plant Quarantine Service is described, and attention is drawn to the serious damage resulting from the introduction many years ago of coffee blight (*Hemileia vastatrix*) and of citrus canker (*Pseudomonas citri*).

TEODORO (N. G.). **The Plant Pest and Disease Control Service of the Philippine Bureau of Agriculture.**—*Philipp. Agric. Rev.*, xviii, 4, pp. 463–549, 1 chart, 1925. [Received July, 1926.]

In addition to the Plant Quarantine Service [see preceding

abstract] a special organization exists in the Philippines for the control of plant pests and diseases within the islands.

Since 1915 a campaign has been waged against coco-nut bud rot [*Phytophthora palmivora*] with the result that the disease is now under control. Measures are also in progress against heart rot (*Fusarium ? cubense*) and bunchy top of abaca (*Musa textilis*). Research work, in which methods of control are stressed, is also being carried out on the more important diseases, and biological studies on the deterioration of abaca fibre are being made. Finally a pressing appeal is made for public co-operation in combating these diseases.

Ultimate exclusion of fruit and Rose stocks probable.—*U.S. Dept. of Agric. Fed. Hort. Board, Service and Regulatory Announcements October–December, 1925,* pp. 93–94, 1926.

In the public consideration in 1918 of the restrictions now incorporated under Quarantine 37 [see this *Review*, iii, p. 688], it was represented that there was a vital necessity, for the time being, for the continued entry into the United States of fruit and rose stocks. At the fruit and rose stock conference on 29th June, 1925, it was informally announced that the recommendations relative to future restrictions on the entry of such stocks presented by the American Association of Nurserymen and by the Society of American Florists and Ornamental Horticulturists would be acceptable to the Department of Agriculture as a tentative basis of action. This announcement was confirmed on 12th December, 1925. The recommendations in question provide for the exclusion of fruit stocks as from 1st July, 1930, and for that of rose stocks as from 30th June, 1929. Earlier action may be taken by the Department in the event of a serious emergency.

Saatenanerkennung und Pflanzenkrankheiten im Jahre 1925. [Seed certification and plant diseases in the year 1925.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst,* vi, 5, pp. 38–39, 1926.

The work of seed certification in Germany during 1925 was conducted on the same lines as in previous years [see this *Review*, iv, p. 640]. The data presented in this paper are based on information supplied by the Chambers of Agriculture for the different provinces (excluding Wiesbaden).

Of the entire area inspected, comprising nearly 255,548 hect., certification was refused in 35,164 hect. or 13·8 per cent. (compared with 13·5 per cent. in 1924). The percentage diseased area among the various crops was as follows: rye 0·5 (compared with 6·8 in 1924); wheat 37·7 (50); barley 15·7 (35·9); oats 22·2 (35·9); and potatoes 78·6 (76·4). The percentage distribution of individual diseases was as follows: bunt of wheat [*Tilletia tritici* and *T. levis*] 4·1 (5·7 in 1924); loose smut of wheat [*Ustilago tritici*] 1·5 (3·2); stripe disease of barley [*Helminthosporium gramineum*] 0·9 (1·1); covered and loose smut of barley [*U. hordei* and *U. nuda*] 3·3 (2·2); loose smut of oats [*U. avenae*] 1·9 (2·1); and flag smut of rye [*Urocystis occulta*] 0·002 (0·005).

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

Vol. V NOVEMBER 1926

Gravatt (G. F.). **Maple wilt.**—*U.S. Dept. of Agric. Circ.* 382, 13 pp., 9 figs., 1926.

A semi-popular account is given of the symptoms, distribution, mode of infection and dissemination, and control of the *Verticillium* wilt of maples [see this *Review*, iv, p. 527], which primarily affects the Norway and sugar maples (*Acer platanoides* and *A. saccharum*); while other hosts include silver maple (*A. dasycarpum*), box-elder (*A. negundo*), Japanese red maple (*A. palmatum rubrum*), sycamore (*A. pseudoplatanus*), and red maple (*A. rubrum*).

The disease has been reported to occur sporadically in the region extending from North Carolina and Tennessee to Canada and westward to Wisconsin. The most striking symptom is the death of one of the limbs of a tree, followed the same year or later by that of other limbs or of the whole tree. The limbs may be killed during the dormant season, the fungus growing up and down in long green streaks in the sapwood, and destroying the branches one above another. Other symptoms of the disease include scanty foliage and the development of a slime-flux area on the affected part, over which the cortex peels off, leaving bare streaks resembling lightning scars. This phenomenon appears to be confined to sugar and red maples. Some trees may show only one of the above-mentioned symptoms, but the streaks in the sapwood are always present and may extend from the leaf petioles down into the root. Sometimes they are also found in the cambium.

The fungus gains admission to the tree through wounds. Infection may be produced by root, branch, or trunk inoculations, and in two cases observed natural infection appears to have occurred through wounded roots. Field observations denote that the progress of the disease is proportional to the vigour of the host. Generally speaking, infection spreads steadily until the tree dies, which takes one to six years after the appearance of the first symptoms.

Control measures should include the excision of infected material,

the painting of all cuts and wounded surfaces with a mixture of creosote and coal-tar, and the sterilization of pruning implements with 1 in 1,000 corrosive sublimate.

GRAVATT (G. F.) & MARSHALL (R. P.). **Chestnut blight in the southern Appalachians.**—*U.S. Dept. of Agric. Circ.* 370, 11 pp., 10 pl., 2 maps, 1926.

Chestnut blight (*Endothia parasitica*), which was first introduced into America in 1904 with a consignment of small nursery trees from Asia, is stated to have completely laid waste the chestnut stands north of the Potomac River and east of the Alleghany Mountains, while the remaining forests of the southern Appalachians are apparently doomed to destruction. A county by county survey begun in 1924 has revealed infections at the southern limit of the commercial chestnut-growing region, and it is estimated that by 1930 more than half, and by 1935 nine-tenths, of the southern Appalachian counties, covering an area of 30,000,000 acres, will show over 80 per cent. of infection in their chestnut stands. The symptoms of the disease and life-history of the causal organism are briefly described in popular terms. No practical control measures are known, but if salvaged before deterioration sets in, the lumber from blighted trees is equal to that cut from live trees. The increased use of such affected chestnut wood for certain constructional purposes is advocated. A brief account is given of the work connected with the selection of resistant oriental varieties, especially *Castanea japonica* and *C. mollissima* [see this *Review*, iii, p. 493].

VAN SWAAY (H.). **Gecreosoteerde dwarsliggers voor de railbanen van Suikerfabriken op Java.** [Creosoted sleepers for the railways of Sugar factories in Java.]—*Arch. Suikerind. Nederl.-Indië*, xxxiv, 20, pp. 523–536, 3 figs., 1926.

Many of the methods of timber preservation used in Europe and America [which are briefly discussed] are stated to be unsuitable for the tropics, where impregnation under pressure with creosote has been found to be the only adequate process. Absolute preservation can be effected by the application of creosote at the rate of 200 to 250 l. per c.m., and the writer was recently informed that creosoted teak [*Tectona grandis*] sleepers supplied by him in 1914 for the railway of a sugar factory are still in excellent condition. In favourable circumstances the duration of softwood sleepers treated in this manner may be estimated at thirty years, compared with an average of seven years for untreated teak and of ten to twelve for iron sleepers. The cost of treated timber may be calculated at 10 to 15 per cent. higher than that of untreated. Various technical matters connected with the work of preservation are discussed. [An abridged English translation of this paper appeared in *Facts about Sugar*, xxi, 31, pp. 737–741, 1926.]

TESSENOW (M.). **Die Bekämpfung der Kohlhernie.** [The control of club-root of Cabbage.]—*Gartenwelt*, xxx, 19, p. 301, 1926.

For several years the writer has obtained excellent control of club-root of cabbage [*Plasmodiophora brassicae*] by the application to

heavily infested soil, three days before planting, of 25 gm. 40 per cent. potash salt (' Kalisalz '), 100 gm. Rhenania phosphate, and 400 gm. calcined lime per sq. m., followed eight days after planting by the admixture of 20 gm. urea per sq. m. White cabbage of the Maispitz variety treated by this method produced heads up to 6 lb. in weight, while the plants in untreated soil gave an insignificant yield.

THUNG (T. H.). **Peronospora parasitica (Pers.) De By attacking Cabbage heads.**—*Phytopath.*, xvi, 5, pp. 365–366, 1 fig., 1926.

The occurrence of *Peronospora parasitica,* which is often believed to be restricted to seedlings, on full-grown cabbage heads in Holland is recorded. The mycelium of the fungus passes from the outer to the inner leaves. The old, yellow leaves near the ground are usually covered with irregular, sharply bordered, black spots occupied by the mycelium and conidiophores. The fungus is said to be known to overwinter by means of oospores, but observations during 1924–5 indicated that the mycelium, which is highly resistant to frost, can also persist in cabbage leaves. Infection may occur in cabbage stored for long periods, the fungus in some cases even penetrating the parenchyma of the stem. The writer agrees with Gäumann (*Beih. Bot. Centralbl.*, xxxv, p. 395, 1918) that the *Peronospora* on *Capsella bursa-pastoris* is a distinct strain which does not attack cabbage [see also this *Review*, i, p. 79]. Control may be effected by the removal of diseased material. White varieties are stated to be more susceptible than red ones.

THUNG (T. H.). **Opmerkingen over Peronospora parasitica op Kool. (Bemerkungen über die Kohl-Peronospora).** [Observations on *Peronospora parasitica* on Cabbage.]—*Tijdschr. over Plantenziekten*, xxxii, 6, pp. 161–179, 2 pl., 4 figs., 2 graphs, 1926. [German summary.]

This is a more detailed account of downy mildew of Savoy and other varieties of cabbage (*Peronospora parasitica*) in Holland than that noticed from another source [see preceding abstract].

The hyphae pass from one leaf to the next through the stomata. Sometimes they form enlargements between the leaves similar to those described by Magnus in the *Peronospora* on *Cheiranthus cheiri* (*Ber. Deutsch. Bot. Gesellsch., Generalversammlungsheft*, p. 39, 1894), but there was no evidence of oospore formation outside the tissues. Hibernation is effected largely by the mycelium.

Temperature and humidity were found to exert a great influence on the dimensions of the conidia. The average measurements of conidia grown in moist chambers at 5° C. were $27{\cdot}08 \pm 0{\cdot}12$ by $23{\cdot}30 \pm 0{\cdot}10\ \mu$, while the mean size of those developing at 20°, under similar conditions of humidity, was $23{\cdot}49 \pm 0{\cdot}10$ by $19{\cdot}59 \pm 0.06\ \mu$. The conidia were classified in two groups, representing distinct biological forms of the fungus: the first characterized by short, ellipsoid individuals and the second by larger, elongated conidia with protuberant apices. The average dimensions of the latter group were 32·51 by 25·66 μ and of the former 26·67 by 23·13 μ,

the corresponding ratios of length to breadth being 1·26 and 1·11, respectively.

The fungus was found to remain alive in cabbage stalks for about three months, when aseptically removed living pieces of stalk were inoculated with conidia. A copious formation of conidiophores and mycelium was obtained on the surface of such pieces. Growth and reproduction can take place at 3° to 4°. During the summer the organism is found chiefly in the lowest leaves of plants in the field.

Control measures should include the removal of infected material and spraying with Bordeaux mixture.

WHITE (R. P.). **Rhizoctonia crown rot of Carrots.**—*Phytopath.*, xvi, 5, pp. 367–368, 1 fig., 1926.

In June, 1924, following a fortnight's excessively heavy rain, *Rhizoctonia* crown rot was observed on carrots near Kansas City. The affected plants showed a decay of the bases of the central leaves, and in severe cases, a soft, brown, conical rot of the crown. Partially decayed older leaves exhibited a reddening of the leaf margins, but it is considered doubtful whether this symptom is specifically associated with the *Rhizoctonia* disease, since it did not appear on artificially inoculated plants. A species of *Rhizoctonia* resembling *R. solani* was isolated from diseased material and inoculated into young and almost mature carrot plants, with positive results at relatively high temperatures and under very humid conditions. The weft of white mycelium, which is stated by Chupp in correspondence to be characteristic of the *Corticium* stage of the disease in New York, developed round the leaf bases. The species is evidently a weak parasite, the attacks of which could be obviated in abnormally wet seasons by wider spacing of the rows to permit free circulation of air between the plants.

BÖNING (K.). **Beobachtungen über Vegetationsschäden durch Teerdämpfe.** [Observations on injury to vegetation caused by tar fumes.]—*Forsch. auf dem Gebiet der Pflanzenkrankh. u. der Immunität im Pflanzenreich*, ii, pp. 79–88, 5 figs., 1 diag., 1926.

The injury caused to young beet plants by exposure to the fumes of smouldering tar from a railway dump is described at some length. The first symptom was a glassy appearance and swelling of the leaves, which were also abnormally dark coloured and brittle. Subsequently the surface of the leaves assumed a silver sheen and a curling or rolling of the margins was observed. The most acute damage, resulting in a loss of two-thirds of the crop, was inflicted on very young plants growing nearest to the smoking tar. Not only the epidermis but also the underlying layer of the assimilating tissue was disorganized. Similar injury was caused experimentally by placing tarred paper between the plant rows. Potatoes, cabbage, *Polygonum aviculare*, *P. convolvulus*, and *Atriplex* sp. were also considerably damaged by the fumes, while graminaceous plants were hardly affected at all.

Böning (K.). **Ueber die Empfänglichkeit von Phaseolus vulgaris für Colletotrichum lindemuthianum im Lichte der Rassenbildung des Krankheitserregers.** [On the susceptibility of *Phaseolus vulgaris* to *Colletotrichum lindemuthianum* in the light of the development of biological strains by the causal organism.]—*Forsch. auf dem Gebiet der Pflanzenkrankh. u. der Immunität im Pflanzenreich*, ii, pp. 4–18, 1926.

In continuation of his previous investigations with Schaffnit on anthracnose of beans (*Colletotrichum lindemuthianum*) [see this *Review*, iv, p. 456] the writer carried out a series of field and laboratory tests at the Bonn Phytopathological Institute on the susceptibility of some twenty German and American varieties of beans to the biological forms α, β, γ, χ_2, χ_4, and χ_8 of the fungus [see this *Review*, iii, pp. 109, 110], authentic cultures of which were obtained from America.

The results of the experiments [which are presented in tabular form] largely confirmed those of the American workers and showed that, in general, both the biological forms and the different bean varieties retain their characters under different environmental conditions. Only two exceptions were observed, namely, Giant Stringless and Bountiful, which remained immune from infection by strain α in the Bonn laboratory tests, while in America they were susceptible. The wax varieties, Dattel, Wunderbutter, and Mont d'Or, which in Germany are highly susceptible to anthracnose, were only slightly attacked by form α, which caused infection, however, on the ordinarily resistant varieties Kaiser Wilhelm and Schwert Nordstern.

The symptoms produced by form α under the conditions of these experiments differed strikingly from those usually associated with anthracnose infection. The usual salmon-pink to brownish-red, frequently water-soaked lesions were replaced by a brown rot of the tissues, sometimes characterized by the complete absence of sporulation. It is uncertain whether this phenomenon is due to the atmosphere of the damp chamber in which the experiments were carried out or to an actual change of virulence on the part of the fungus. It is thought that the Bonn form of *C. lindemuthianum* most closely resembles the American strain β.

A brief discussion is given on the problem of biological forms and its bearing on the relations between host and parasite.

Muller (H. R. A.). **Physiologic forms of Colletotrichum lindemuthianum (Sacc. et Mag.) Bri. et Cav. in the Netherlands.** —*Phytopath.*, xvi, 5, p. 369, 1926.

The writer has discovered the existence of five biological forms of *Colletotrichum lindemuthianum*, the causal organism of bean anthracnose, which differ from those occurring on the varieties used in experiments by American investigators. Four forms were isolated from diseased pods of *Phaseolus vulgaris* in different parts of Holland, and one from a pod of *P. multiflorus*. These forms differed in pathogenicity and in growth and appearance of the colonies on culture media. All except the last produced the ascogenous stage in the laboratory.

SZEMBEL (S. J.). Некоторые наблюдения над биологией головневого гриба **Urocystis cepulae Frost.** [Some observations on the biology of the smut fungus *Urocystis cepulae* Frost.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 524–530, 1926.

The observations reported in detail in the present paper were made by the author in 1914, on the occasion of a heavy outbreak of onion smut, *Urocystis cepulae,* in a market garden in the neighbourhood of Astrakhan. The interesting feature of the outbreak was that the disease occurred on a plot on which onions had already heavily suffered from it some ten years previously and which in the interval had not been used for this or any allied crop. Onions raised from seed sown in the plot were practically all infected, while onions planted as seedlings in the immediate proximity remained entirely immune, both lots having been raised from seed produced by the owner of the ground. This would indicate that the spores of the organism may survive in the soil for many years even in the absence of its host. On the ground of a number of infection experiments, the author believes that the onion is only susceptible to infection during the germination stage. In the region of Astrakhan the fungus attained its maximum virulence in 1916, since when it has almost entirely disappeared, as well as the onion mildew, *Peronospora schleideni,* which, some years ago, was very prevalent. *U. cepulae* was also found on the wild onion, *Allium sabulosum,* growing in sand dunes near Krasnoyarsk, on the coast of the Caspian Sea.

WILLIAMS (P. H.). **'Damping off' of Cucumber seedlings.**—*Eleventh Ann. Rept. Cheshunt Exper. and Res. Stat., Hertfordshire, 1925,* pp. 72–75, 1926.

A description is given of a 'damping-off' of cucumbers caused by a species of *Phytophthora* differing from both *P. parasitica* and *P. cryptogea,* the organisms largely responsible for the damping-off and foot rot of young tomatoes [see this *Review,* i, p. 373]. Soil inoculations both before sowing the cucumber seed and after the seedlings had appeared above ground, with the fungus isolated from diseased specimens, resulted in severe damping-off, the controls remaining healthy, and the fungus was successfully reisolated from the infected plants. Older cucumber plants do not appear to be susceptible to the disease.

Comparative inoculation experiments with *P. parasitica* from tomato seedlings and the fungus from the cucumber showed that the former could not infect the cucumber, nor the latter the tomato. Mature tomato plants were infected at soil level by *P. parasitica* and both fungi were able to produce a rot of tomato fruits.

BEWLEY (W. F.). **Mosaic disease of the Cucumber.**—*Eleventh Ann. Rept. Cheshunt Exper. and Res. Stat., Hertfordshire, 1925,* pp. 86–89, 1 diag., 1926.

The results of investigations on the seed transmission of cucumber mosaic [see this *Review,* v, p. 142] showed that out of 2,000 seeds taken from diseased plants nine were found infected at the pot stage, and by following up the history of different batches of seed grown by nurserymen strong circumstantial evidence of seed trans-

mission was obtained. The possibility of control by the use of clean seed has been tested with apparent success, although it is admitted that further trials are necessary before any definite assertions can be made.

The belief is common among growers that the disease can be contracted from the soil, and an outbreak of disease among plants from clean seed (sown partly on old beds and partly on new) certainly suggested soil infection. Further critical experiments on this matter have been arranged.

SERBINOV (I. L.). О новом массовом актиномикозе плодов Сладкого Перца. [A new epidemic outbreak of actinomycosis of Sweet Chilli fruit.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 537–546, 3 figs., 1926.

Sweet chillies, *Capsicum annuum*, are stated to be severely attacked by an actinomycosis of the fruits in Bessarabia and in the whole region between the Dnieper and the Dniester. Field observations during the last four or five years suggest that infection generally occurs at the moment of pollination through the agency of insects or even of dust particles floating in the air. The first symptom—a pale green or brownish discoloration, gradually increasing in size, under which the tissues soon dry up and wrinkle in dry weather or develop a wet rot in rainy weather—usually appears at the apex, but may also occasionally occur at the side of the fruit, which is finally killed. The causal organism, which was isolated in pure culture [and the morphological and cultural characters of which are briefly noted] has not been previously described, as far as the author is aware, and the name *Actinomyces totschidlowskii* is given to it. It stands closest to *A. albus* Gasp., from which it differs by the dimensions of its cells (1·4 to 5·6 by 0·35 to 1·5 μ) and by its formation in plate cultures of radiating, powdery colonies with a chalk-like efflorescence of oidia. Of late years the infection has shown a tendency to spread to the seeds of the sweet chilli, which are then deformed and lose their germinability or give rise to diseased seedlings. The disease is not transmissible either to the hot varieties of chilli or to other vegetables.

YOSHY (H.). **The bacterial soft rot of Pepper.**—*Journ. Agric. Exper. Stat., Chosen* [Korea], xiv, pp. 1–15, 3 pl., 1926. [Japanese with English summary.]

A study has been made of the bacterial soft rot of pepper (*Capsicum annuum*), which affects chiefly the green fruit from the beginning of August onwards. The losses caused by the disease may amount to 10 to 20 per cent. of the yield. Infection generally originates in punctures made by the insect *Chloridea* [*Heliothis*] *assulta*. The causal organism, the group number of which is 221.2223022, is stated to be a strain of *Bacillus carotovorus*. It resembles *B. aroideae* [see this *Review*, iv, p. 196] but differs in its indol reaction and pathogenicity to the Calla lily (*Calla palustris*).

HIGGINS (B. B.). **Anthracnose of Pepper (Capsicum annuum L.)**—*Phytopath.*, xvi, 5, pp. 333–345, 2 pl., 1926.

A study of anthracnose of pepper (*Capsicum annuum*) [see this

Review, iv, p. 649; v, p. 402] has shown that of the five distinct species of *Gloeosporium* and *Colletotrichum* occurring on the fruits and other parts of the plant, only one, *G. piperatum* E. & E., is actively parasitic. This comparatively rare organism attacks the fruits in all stages of development and occasionally produces spots and girdling of the stems and branches. The other four fungi, namely, *C. nigrum* E. & H., *C.* sp., *Glomerella piperata* (Stonem.) S. & v. S., and *G.* sp., are wound parasites which enter and may enlarge blossom-end rot spots and other lesions on pepper pods. These are the forms most common in the field.

G. piperatum produces circular to elliptical, depressed, dirty green to yellowish (later brown) spots, 1 to 2 cm. in diameter, on green and ripe fruits, branches, and stems. Erumpent, circular to oblong, yellowish-orange to salmon acervuli are formed within the epidermal or subepidermal cells. The unicellular, hyaline, short rod-shaped conidia measure 5·4 to 6·2 by 15·5 to 18·6 μ. Its perithecial stage is unknown.

C. nigrum has very distinctive characters [which are briefly described] and shows evident relationship to *C. tabificum* [*C. atramentarium*] in its production of small black sclerotia.

Glomerella piperata produces pale straw-coloured spots dotted with small, erumpent acervuli with black, septate, tapering setae in varying numbers. The continuous, hyaline, cylindrical conidia measure 3·5 to 6 by 10·5 to 25 μ. The perithecial stage is fully described.

In *G.* sp. the slender clavate asci measure 12 by 40 to 80 μ; the hyaline to smoky, straight, oblong, eventually uniseptate ascospores 6 to 9 by 12 to 18 μ; and the hyaline, short cylindrical, continuous conidia 4 to 6·5 by 16 to 21 μ.

G. piperatum apparently penetrates the cuticle by means of a cutin-dissolving substance produced by the appressorium or by the infection tube. The mycelium secretes some toxic substance which kills the host cells in advance of the hyphae. The cellulose and hemi-cellulose membranes of the host tissue are readily destroyed by the fungus, but cutinized and lignified membranes are very resistant to its action. The spores come into contact with the surface of the pepper seed during the process of cleaning, and attack the seedlings as they emerge from the seed coat. The incidence of infection can be greatly reduced by soaking in water followed by five minutes' immersion in a solution of 1 in 1,000 corrosive sublimate or by ten minutes in 1 in 60 copper sulphate.

BOGAYONG (J. R.). **Anthracnose of Eggplant.**—*Philipp. Agric. Rev.*, xviii, 4, pp. 558–559, 1 pl., 1925. [Received July, 1926.]

In this circular [No. 168 of the Bureau of Agriculture] a description is given in popular terms of the anthracnose (*Gloeosporium melongenae*) of eggplants (*Solanum melongena*), which is stated to be of frequent occurrence in the Philippine Islands.

GOMEZ (E. T.). **'Blight of Gabi' (Phytophthora colocasiae Rac.) in the Philippines.**—*Philipp. Agric. Rev.*, xviii, 4, pp. 560–561, 1 pl., 1925. [Received July, 1926.]

In this circular [No. 169 of the Philippine Bureau of Agriculture]

the author gives a general account of the symptoms, life-history, and control of the blight disease of 'gabi' or 'taro' (*Colocasia esculenta*, *C. antiquorum*) caused by *Phytophthora colocasiae* [see this *Review*, v, p. 341].

HOC (P.). **Le remplacement des manquants dans les Vignes atteintes d'apoplexie.** [The replacement of missing individuals among Vines attacked by apoplexy.]—*Journ. d'Agric. Prat.*, xc, 24, pp. 476–478, 1926.

In connexion with the recent ravages in French vineyards caused by 'apoplexy' [*Stereum necator*: see this *Review*, v, p. 592], the writer recommends and fully describes a special method of layering based on the use of shoots developing from the eyes situated at the axil of the first leaves. Shoots developing next to the grape clusters should be selected for propagation whenever possible. The grafting operations [detailed instructions for which are given] should be carried out in June or July.

FAES (H.) & TONDUZ (P.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport Annuel, 1925.** [Annual report for 1925 of the Federal Viticultural Experiment Station at Lausanne and Domaine de Pully.]—*Annuaire Agric. de la Suisse,* xxvii, 2, pp. 241–270, 2 pl., 6 figs., 1926.

The following references of phytopathological interest occur in this report. Downy mildew of the vine (*Peronospora* [*Plasmopara*] *viticola*) was not very severe in 1925, but, as in the previous year, good results were obtained in its control with ordinary [3 per cent.] Bordeaux mixture, with or without the addition of skim milk as an adhesive, and with certain colloidal copper mixtures [see this *Review*, v, p. 276].

Oidium (*Uncinula necator*) was very prevalent during the period under review, especially in the central and northern regions of the canton of Vaud, where hailstorms caused much damage to the vineyards.

The pycnidia and spores of coître [livid rot of the vine or hail disease], caused by *Coniothyrium diplodiella* [ibid., v, p. 277], have retained their viability for five years in the laboratory. The application of sulphur dust to freshly infected grapes failed to control the disease, while the admixture of sulphur with soil containing the spores of the fungus was also ineffectual.

Encouraging results have been given in the control of apoplexy of the vine [*Stereum necator*: ibid., v, p. 592] by winter applications of basic solutions of arsenical salts.

The disease of apricots caused by *Monilia* [*Sclerotinia*] *laxa* [ibid., v, p. 277] is stated to be yielding to treatment in a satisfactory manner and a good yield was obtained in 1925.

LIBUTTI (D.). **Combattiamo la Peronospora della Vite.** [Let us control the *Peronospora* of the Vine.]—*L'Istria Agric.*, vi (N.S.), 8, pp. 186–189, 1926.

The relation between meteorological conditions and the outbreak of downy mildew (*Peronospora*) [*Plasmopara viticola*] is discussed in general terms with special reference to the critical periods for the

application of preventive sprays. Good control was given in north-eastern Italy in 1925 (when the disease was very severe) by Bordeaux mixture and Caffaro powder [see this *Review*, i, p. 66]. In seasons favourable to the development of the fungus, the application of dusts (sulphur mixed with 3 to 5 per cent. copper sulphate or 10 to 20 per cent. Caffaro powder) should be preceded by liquid treatment, the former alone not being sufficiently efficacious under such conditions. For susceptible vines, e.g., Malvasia, Bordeaux mixture should be used at the rate of $1\frac{1}{4}$ to $1\frac{1}{2}$ kg. of copper sulphate per hectol. of water, and in cases of very severe infection 125 gm. of ammonium chloride may be added to a neutral Bordeaux mixture.

Serbinov (I. L.). К этиологии „швейцарской Виноградной оспы". [On the etiology of the 'variole suisse' of the Vine.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 556–561, 1926.

The vineyards in the governments of Odessa and Nikolaieff are stated to have been severely attacked in 1924 by a disease until then unknown in the region, the symptoms of which agree with those briefly described by Kirchner ('Krankheiten und Beschädigungen landwirtschaftl. Kulturpflanzen,' pp. 356, 361, Stuttgart, 1890) under the name 'schweizerische Rebenpocke' ('variole suisse de la vigne'). At the beginning of July the vine leaves, especially towards the apex of the shoots, developed from five to ten brownish or reddish spots, at first a few millimetres in diameter and gradually attaining the size of a pea. In time the spots coalesced and took on a vivid red, or, in some varieties, a purple-red colour. The under side of the affected leaves was partially covered with a delicate whitish or greyish mycelium, on which in September and October developed agglomerations of spores of *Macrosporium vitis* Sorokin (described in Sorokin's book 'Some diseases of the Vine and other plants in the Caucasus,' Tiflis, 1892, and in Jaczewski's 'Key for the determination of fungi,' Petrograd, 1917). In some plants the shoots bearing affected leaves were very slow in maturing their wood, and showed towards the apex small swellings from 1 to 6 mm. in length and from 2 to 6 mm. high. These swellings hardly increased in size, turned brown, and dried up; towards the end of the summer they entirely disappeared without leaving any traces on the shoots. There is evidence to show that the presence of such swellings on the shoots was much more an individual than a varietal feature, and that they appeared on vine stocks the vitality of which had been lowered from any cause.

Histological examination of the diseased vines showed that the disease is a mixed infection, the primary part in which is played by *Micrococcus staphylophagus* f. *vitis* Serb. and *M. malolacticus* Seifert, *Macrosporium vitis* being only a secondary organism. The control measures recommended consist in adequate applications of nitrogenous, potash, and acid phosphate fertilizers, and in the removal and burning of all infected organs of the vines.

Marchal (P.) & Foëx (E.). **Rapport phytopathologique pour l'année 1925.** [Phytopathological report for the year 1925.] —*Ann. des Épiphyties*, xi, 6, pp. 412–470, 1925. [Received June, 1926.]

Notes are given on the diseases occurring in France during 1925

on cereals; fodder crops; beetroot, potato, tobacco, and hops; vegetables; fruits; vines; forest trees; and exotic and ornamental plants. In addition to matters already noticed in this *Review* from other sources, the report contains a mass of interesting information from which the following passages are selected.

Lucerne (*Medicago sativa*) was frequently attacked by *Urophlyctis alfalfae* [see this *Review*, iv, pp. 170, 593] at Bussy-les-Poix (Somme).

Ramularia beticola was observed from early August onwards in the beet fields of the Aisne and reported also from Seine-et-Oise. *Rhizoctonia violacea* [*R. crocorum*] occurred in the departments of Bas-Rhin and Lot-et-Garonne.

Investigations have shown that the potato area affected by wart disease (*Synchytrium endobioticum*) in the Bruche valley (Bas-Rhin) [ibid., v, p. 321] covers at present some 200 acres, occupied chiefly by the highly susceptible Wohltmann and Industrie varieties. The results of local inquiries indicate that the disease has been present for three years, infection having been introduced with a consignment of potatoes from Holland. About 20th September a fresh centre of infection was detected at Grandfontaine (Bas-Rhin).

Details are given of the incidence of potato blight (*Phytophthora infestans*) in different regions; the maximum intensity of the disease over the greater part of France was recorded at the end of August and during September [ibid., iv, p. 763].

Potato wilt (*Colletotrichum atramentarium*, formerly known as *Vermicularia varians*) [ibid., v, p. 447] was again reported in various localities, generally in a mild form. Beneficial effects followed treatment with calcium sulphate and arsenate of soda in Haut-Rhin, and with nitrate of lime in the Loire valley. Numerous inoculation experiments with the causal organism on different vegetables are stated [on p. 487] to have given negative results.

Since 1924 a disease superficially resembling wildfire [*Bacterium tabacum*] has been observed in Alsatian tobacco plantations.

Hop mildew (*Pseudoperonospora humuli*) [see this *Review*, v, p. 186] has been found to extend from Calvados and the Somme to Sarrebruck and Strasbourg. The presence of this disease in Burgundy and Alsace constitutes a menace to the hop-growing industry.

Tomatoes were severely attacked in Seine-et-Oise during August to October by late blight (*P. infestans*), which particularly affected the fruit. Cross-inoculation experiments showed that the fungus isolated from tomato readily infects potato foliage, and vice versa. There was no difference in the degree of infection produced on potato leaves by the fungus from either source, and there can thus be no question of biological forms [see also this *Review*, v, p. 524]. Spraying operations should be directed mainly towards the protection of the fruit.

Ascochyta hortorum attacked the stems and leaves of tomato plants in Seine-et-Oise. Infection was shown frequently to proceed from stakes used in the previous year.

Mild attacks of mildew (*Bremia lactucae*) on artichokes (*Cynara scolymus*) were reported from Seine-et-Oise.

Spinach was affected by a disease thought to be related to mosaic in Seine-et-Oise and elsewhere.

Young chestnut trees (*Castanea* spp.) at Ussy (Calvados) were reported to be frequently attacked by mildew (*Microsphaera quercina*).

Poplar trees (*Populus canadensis*) in the Valois district of Oise were affected by the bacterial canker attributed by Delacroix to *Micrococcus populi*. *P. carolinensis* in the Garonne valley was attacked by *Cenangium populneum*.

The dying-off of elms [see this *Review*, v, p. 334], the cause of which remains obscure, was recorded in Picardy, the environs of Paris, the south-west, and probably elsewhere.

At the conclusion of this report, on pp. 486–494, summaries are given of the work of the Phytopathological Stations of Brive and Grignon.

VAN HALL (C. J. J.). **Ziekten en plagen der cultuurgewassen in Nederlandsch-Indië in 1925.** [Diseases and pests of economic crops in the Dutch East Indies in 1925.]—*Meded. Inst. voor Plantenziekten*, 70, 51 pp., 1926.

This report, which has been prepared on similar lines to those of previous years [see this *Review*, iv, p. 594] contains, *inter alia*, the following references of phytopathological interest.

In Sumatra the quality of the potato crop was greatly impaired by sprain, to which the apparently immune Carman variety also succumbed. The disease was found to occur in a severe form on soil never previously used for potatoes. Slime disease (*Bacterium solanacearum*) caused the most severe damage to potatoes on the Karo plateau, and in the Tjimahi district. Mosaic and leaf roll were prevalent, while scab (*Actinomyces scabies*), early blight (*Alternaria solani*), and black scurf (*Rhizoctonia solani*) are also recorded.

During the period under review, the normally resistant groundnut (*Arachis*) [*hypogaea*] varieties, Z.L. 21 and Hybrid No. 3, were slightly attacked by *Bact. solanacearum*, but very satisfactory results were given by a number of new varieties in susceptibility tests on heavily infected soil. The disease caused severe damage on red laterite soils at high altitudes in Cheribon, Indramajoe, and Pekalongan, the total loss in the two first-named districts being estimated at 20 per cent. Sporadic attacks were reported from various localities. *Cercospora personata* was prevalent in Soemedang.

Vigna [*oligosperma*] was attacked by *Rhizoctonia* [*solani*] [see this *Review*, v, p. 517] during the rainy season in Besoeki, where pink disease [*Corticium salmonicolor*] and the grey dadap fungus (*Septobasidium bogoriense*) were also reported on *Crotalaria anagyroides* [ibid., v, pp. 253, 475] and *Tephrosia candida*. *C. usaramoensis* is becoming increasingly liable to infection by the black leaf fungus [*Parodiella spegazzinii*, see this *Review*, v, p. 254], which also occurs on other varieties of *Crotalaria* on the east coast of Sumatra. *Sclerotium rolfsii* was recorded on *C. anagyroides*, *C. usaramoensis*, and *C. juncea* in Cheribon and elsewhere, the last-named species being affected also by leaf curl. *Deguelia* [*Derris*] was attacked by *Ganoderma lucidum*.

On the west coast of Sumatra the cultivation of tomatoes was largely prevented by *Bact. solanacearum.*

Brown bast of *Hevea* rubber appears to be on the increase in Malang and the east coast of Sumatra, 30 per cent. of the trees ceasing production in the latter district. A decline in the incidence of this disease is reported from other parts. *Corticium salmonicolor* caused much damage in a five- to six-year-old rubber plantation with a rainfall above 3,000 mm. *Sphaeronema fimbriatum* [*Ceratostomella fimbriata*] was reported on rubber bark for the first time from the east coast. Severe injury to rubber was caused by *Ganoderma* [*pseudo*] *ferreum* and *Rigidoporus microporus* [*Fomes lignosus*: ibid., iv, p. 701; v, p. 54], the former affecting primarily old plantations and the latter young ones. Immature fructifications of *Xylaria thwaitesii* [ibid., ii, p. 576] were found on rubber roots in West Java. A report from Malang states that stripe canker (*Phytophthora faberi*) was of importance only in densely planted rubber or where coffee is interspersed with the rubber.

A disease of cacao of unexplained origin has been reported from the north Bantam region, where some 400 to 500 trees were affected by wilting and yellow discoloration of the foliage, dropping of the fruit, and ultimate breaking of the entire crown.

The obscure disease of cloves [*Eugenia caryophyllata*] previously reported [ibid., iv, p. 80] continues to cause heavy damage in Tapanoeli.

Crown rot of oil palms [*Elaeis guineensis*] was virtually confined to two- to three-year-old plantations. A normally saprophytic species of *Marasmius* caused some injury to living fruit clusters and petioles of oil palm during the rains.

A leaf disease of rice caused by a species of *Scolecotrichum* was reported from Indramajoe.

Mosaic of sugar-cane was reported chiefly from East Java on the S W 3, D I 52, and E K 28 varieties. Sereh disease was prevalent even on the normally resistant E K 28, especially in the coastal regions.

Stem rot of tobacco (*Pythium* spp.) caused much damage in Deli. Leaf spot (*Cercospora nicotianae*) was prevalent, and *Rhizoctonia* was observed in seed-beds for the first time. Mildew [? *Erysiphe cichoracearum*: see this *Review*, iv, p. 131] was much in evidence in the Vorstenland; good control was secured by the application of sulphur dust to the soil.

Tea was attacked by *Fomes lignosus, Ganoderma pseudoferreum, Fomes lamaoensis,* and *Rosellinia,* while *Septobasidium bogoriense* occurred in a serious form on this host for the first time.

SHARPLES (A.). **Annual Report of Mycologist for 1925.**—*Malayan Agric. Journ.*, xiv, 6, pp. 160–164, 1926.

The relationship between the method of tapping and bark diseases of rubber, to which the author drew attention in his previous annual report [see this *Review*, v, p. 79], was strikingly illustrated in 1925. Various economic factors led in some instances, especially towards the end of that year, to deeper and less careful tapping, this resulting in the exposure of the tender cambial tissue which

rapidly dries in the sun and leaves open wounds. Over the surface of the wood so exposed, and round its edges, a delicate white mould was usually observed, frequently extending over the surface of the renewing bark. The mould, in which a common *Fusarium* species and a species of *Cephalosporium* are involved, was more prominent where slight weeping of latex had occurred, such cases simulating true mouldy rot [*Ceratostomella fimbriata*] very closely. In most cases, however, the further development of the fungi was checked by early painting of the tapping cuts with disinfectants.

The Keuchenius method of treatment against brown bast [see this *Review*, iv, p. 766] was tried in Malaya, with but partial success.

HANSFORD (C. G.). **Report of the Microbiologist.**—*Ann. Rept. Dept. Sci. and Agric. Jamaica for the year ended 31st December, 1925*, pp. 12–14, 1926.

Both in the field and in laboratory tests, banana trash has again been definitely implicated in the spread of Panama disease (*Fusarium*) [*cubense*: see this *Review*, v, p. 214] in Jamaica. A provision of the Banana Trash Order provides for the more efficient control of the movement of this material.

On p. 10 of the report it is stated that the number of plants affected by Panama disease has risen from 6,698 in 1924 to 14,199 in 1925. Infection is now said to be spreading to the mountains with the general migration of cultivators, who have taken suckers from their old cultivations with them, from the infected valleys of Portland. The floods of November, 1924, appear to have been largely responsible for the spread of the disease on the lower levels. On account of the continued progress of the disease, modifications have been made in the quarantine regulations, the area of quarantine in severely affected regions being reduced from the prescribed one chain radius to one square chain. Experiments have also been instituted with other methods of treatment. Two resistant varieties imported during the year, namely, the Giant Fig from Grenada and the Bumelan from Surinam, will be used as parents in breeding work. It is stated on p. 2 of this report that encouraging results were also given by the Robusta variety on clay soil.

Several specimens suspected of infection by Panama disease presented a water soaked appearance of the bulb, which was followed by a soft, spongy rot of the tissues, associated with bacterial invasion. None of the internal symptoms of Panama disease was present, and the trouble is believed to be due to excessive waterlogging, especially on heavy clay soils.

Other comparatively unimportant banana diseases which are still present in Jamaica include *Marasmius* rot of rhizomes; black spot disease (*Cercospora musarum*); Bonnygate disease (*Sphaerostilbe musarum*); heart-leaf rot, due to an undetermined cause; and pineapple disease (*Thielaviopsis paradoxa*).

It has recently been observed that spring plants of sugar-cane are much more severely attacked by mosaic than those sown in the autumn [see also this *Review*, v, p. 329]. Thus autumn planting considerably reduces the amount of infection in the first crop.

Aphis maidis is still the only insect definitely known to transmit mosaic, though various others are under suspicion.

A severe attack of *Helminthosporium sacchari* on young cane sprouts was reported from one estate.

Several cases of heavy infection by scab (*Sporotrichum citri*) were recorded on sour orange [*Citrus aurantium*] seedlings. A dieback of grapefruit [*C. decumana*], for which *Colletotrichum gloeosporioides* was only partially responsible, was attributed largely to the marked deficiency of lime and potash in the soil, combined with high acidity.

Omphalia flavida occurred on densely shaded coffee during the damp weather early in the year.

Mosaic of tobacco is prevalent but not serious. Black shank disease (*Phytophthora nicotianae*) caused considerable damage to Virginia tobacco, amounting in one case to 20 per cent. of the crop.

Scab (*Actinomyces scabies*) was of frequent occurrence on potatoes. Considerable injury was caused to the tomato crop by *Cladosporium fulvum* and *Septoria lycopersici*.

Department of Botany and Plant Pathology.—*Oregon Agric. Exper. Stat. Director's Bienn. Rept. 1922–1924*, pp. 66–73, 1924. [Received August, 1926.]

In addition to matters which have already been noticed from other sources, this report contains the following points of interest.

Virus diseases of the potato appear to be greatly on the increase in Oregon, rugose mosaic [see this *Review*, iii, p. 548] being most important, while mild mosaic, witches' broom [ibid., iv, p. 55], leaf roll, spindle tuber, leaf rolling mosaic, and giant hill [ibid., v, p. 179] also occur. Preliminary researches denote the urgent necessity for the widespread adoption of seed selection, the use of isolated sites for planting (at least 300 ft. from any other potatoes), and systematic roguing from the beginning to the end of the season.

Cane fruits [*Rubus* spp.] are liable to various disturbances possibly due to a virus, namely, 'webbing', 'pencilling', and 'attenuation' of the foliage. Red raspberries in western Oregon are subject to severe infection by rust (*Phragmidium imitans*). *Septoria rubi* is stated to be responsible for serious damage to loganberries [*Rubus loganobaccus*] and to Himalaya and Mammoth blackberries.

An extensive survey has shown that from 80 to 90 per cent. of mature trees in prune and peach orchards are suffering from heart rot, decay being present in 30 to 40 per cent. of the wounds inflicted in pruning, whilst on apple trees up to 11·5 per cent. of pruning cuts were infected. In carefully tended orchards, however, there was only a comparatively small percentage of decay. Bordeaux-linseed oil paint has proved to be an excellent covering for wounds, being practically innocuous to the exposed cambium, apparently air-porous, and not hard enough to interfere with callus growth, whilst its effects persist for at least three years.

In connexion with some experiments in the control of *Rhizoctonia* [*solani*] in potatoes, it was observed that less disease developed in a heavily infected crop grown from seed treated with corrosive sublimate than in one raised from apparently clean, untreated seed. Preliminary experiments in the substitution of dusts for liquid

preparations in the control of late blight [*Phytophthora infestans*] have given very encouraging results.

Lucerne in the Willamette Valley and in southern Oregon was severely attacked by a fungus believed to be identical with *Sclerotinia trifoliorum*, which was noticeably more prevalent on fields recently used for clover or fertilized with manure from clover hay.

Copper carbonate and sulphur dusts were tested for the control of onion smut [*Urocystis cepulae*], but the former caused a marked reduction in germination and neither produced nearly as good control as formaldehyde [see this *Review*, iv, p. 251].

The results of an extensive series of rod-row tests on the value of dusts in the control of bunt of wheat [*Tilletia tritici*] showed that four high-grade brands of copper carbonate, containing 50 per cent. or more copper, gave practically equal control. In cases of slight infection, four low-grade brands, containing 10 to 22 per cent. copper, were just as efficacious as the high-grade brands, but they proved markedly inferior under conditions of heavy artificial contamination. No better control was given by the use of 3 or 4 oz. per bushel than by 2 oz., except where the infection was excessive. Du Pont semesan, corona 620, and seed-o-san were approximately equal in efficiency to the low grades of copper carbonate.

Cheat grass (*Bromus secalinus*), which is largely grown in the Willamette Valley as a hay crop, is very liable to smut (*Ustilago bromivora*), and a small test was made of various seed treatments for the control of this disease. Semesan and copper carbonate, both applied in excess quantity, reduced infection from 8·5 to 0 and 0·14 per cent., respectively. Good results were also given by the copper sulphate dip (1 lb. per 5 galls.), and by ten minutes' immersion in hot water (130° F.) after 5½ hours' pre-soaking, the latter treatment, however, causing some injury to germination.

PORTER (R. H.). **A preliminary report of surveys for plant diseases in East China.**—*Plant Disease Reporter*, *Supplement* 46, pp. 153–166, 1 map, 1926.

This report deals with the writer's observations of plant diseases in eastern China since the autumn of 1923. Most of the diseases recorded are common in the United States also, but data concerning a number of others, some of importance, have been reserved for incorporation in a future report.

Both loose and covered smut of barley (*Ustilago nuda* and *U. hordei*) are coextensive with the distribution of the crop; stripe disease (*Helminthosporium gramineum*) is also prevalent.

During the wet season of 1925, *Physoderma zeae-maydis* was quite common on maize in the region of Nanking. The average percentage loss from this disease is 3, the corresponding figures for smut (*U. maydis*) [*U. zeae*] and leaf spot (*H.* sp.) being 4 and 7, respectively.

Kaoliang (sorghum) was extensively affected by leaf spot (*Cercospora* sp.) round Kaifeng (Honan Province), the average loss being 5 per cent. The corresponding figures for loose kernel smut (*Sphacelotheca cruenta*), anthracnose (*Colletotrichum lineola*), leaf stripe (*Septoria pertusa*), and head smut (*Sorosporium reilianum*) were 4, 4, 4, and 3, respectively.

[Italian] millet [*Setaria italica*] was in certain cases affected to the extent of 50 per cent. by smut (*Ustilago crameri*), the average loss from which was 8 per cent. Downy mildew (*Sclerospora graminicola*) appears to be widespread in the north, the average loss being 6 per cent. This is one of the most common and destructive diseases of the millet. Rust (*Uromyces leptodermus* Sydow) is also widely distributed, causing an average loss of 5 per cent.

Flag smut of wheat (*Urocystis tritici*) seems to be almost as prevalent as loose smut (*Ustilago tritici*), causing losses ranging from a trace to 20 per cent.

Broad beans (*Vicia faba*) suffer considerably from rust (*Uromyces fabae*) and mosaic every year in the Lower Yangtse Valley.

Anthracnose of cotton (*Glomerella gossypii*) is very common on American varieties, the native ones being apparently less susceptible.

Downy mildew of rape [*Brassica* sp.], caused by *Peronospora parasitica*, is very common in the spring during damp, cool weather in the Yangtse Valley, while leaf spot (*Alternaria brassicae*) is practically ubiquitous.

A. brassicae is also very prevalent on cabbage, which is further attacked by a destructive bacterial rot in wet weather.

A number of fruit diseases, mostly common and cosmopolitan, are also listed.

ISRAILSKY (W. P.). **Bakteriophagie und Pflanzenkrebs.** [Bacteriophagy and plant cancer.]—*Centralbl. für Bakt.*, Ab. 2, lxvii, 8–15, pp. 236–242, 1 pl., 1926.

The bacteriophage of *Bacterium tumefaciens* was isolated from tumours artificially produced on *Beta vulgaris* by inoculation with the crown gall organism. Tests of its heat-resisting capacity showed that at a temperature of 70° C. the bacteriophage was destroyed, while at 55° it was scarcely affected. As a result of experiments to determine the effect of other species of micro-organisms on the bacteriophage, it was found that the latter was present in the filtrate seven days after its contamination by other species of bacteria and in the inoculated soil sample after seven days' incubation at 30°. It was found impossible, however, to isolate the bacteriophage from one-day-old cultures of *Bact. tumefaciens*, although eleven filtrations were made. Strains of the *Bacterium* resistant to the bacteriophage exist, as out of nine cultures isolated from tumours of *B. vulgaris* only two were disintegrated by the action of the bacteriophage. The difficulty of isolating *Bact. tumefaciens* from the tumours and the small number of bacteria contained in the latter are ascribed to the presence of the bacteriophage.

ERIKSSON (J.). **Aide-mémoire relatif à de nouvelles recherches sur la rouille des céréales.** [Memorandum relative to new investigations on cereal rusts.]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 111–116, 1926.

The author outlines, in considerable detail, with bibliographical references, a scheme for the further investigation of problems awaiting solution with regard to the five cereal rusts: *Puccinia*

glumarum, *P. graminis*, *P. dispersa*, *P. triticina*, and *P. coronifera* [*P. lolii*].

PETRI (L.). **Lo stato attuale di alcune questioni concernenti le ruggini dei cereali.** [The present situation with regard to cereal rusts.]—*Boll. R. Staz. Pat. Veg.*, vi, 2, pp. 89–107, 1926.

The author calls attention to the need for extended research on cereal rusts (*Puccinia* spp.) in Italy, where these rusts cause severe damage. With this object in view he gives a general account of the principal species and their biological forms.

From the practical standpoint the constancy of biological forms is regarded as having been demonstrated, and the necessity of determining what forms occur in Italy in order to ascertain the degree of resistance to each of them possessed by the cereal varieties cultivated is emphasized. The possibility of the existence of still unknown forms has, however, to be borne in mind, and also the danger that newly selected varieties may prove susceptible to existing forms to which the cultivated cereals now grown are resistant.

GONZÁLEZ FRAGOSO (R.). **Las 'royas' de los cereales.** [Cereal rusts.]—*Bol. Estac. Pat. Veg.*, i, 2, pp. 41–48, 4 figs., 1926.

In this paper the author describes the morphological and biological characteristics of the species of *Puccinia* most prevalent in Spain. Although it is generally believed that the black rust (*P. graminis*) is the only species responsible for the severe losses to cereals recorded in the country, it is stated that a number of other species are of frequent occurrence and cause considerable damage.

Black rust (*P. graminis*) is particularly severe in the mountainous districts and in the province of Cuenca wherever the alternate host, barberry (*Berberis vulgaris* and *B. hispanica*), is common. The excellent results obtained in other countries in the control of this disease by legislation enforcing barberry eradication are briefly outlined, and emphasis laid on the importance of similar steps being taken in Spain.

Brown rust of rye (*P. dispersa*) is very prevalent, the aecidial stage occurring on *Anchusa*, *Lycopus*, and probably other Boraginaceae. The orange rust of wheat (*P. triticina*) is also common. There is some doubt if the aecidia of this species are produced on *Clematis* or *Thalictrum* [see this *Review*, v, p. 25] or both. It is certain, however, that the uredospores and teleutospores can develop and be propagated without the formation of aecidia.

Yellow rust (*P. glumarum*) is extremely widespread and causes severe damage to cereals in general. Crown rust (*P. coronifera*) [*P. lolii*] of oats also attacks *Lolium* species. The aecidial stage is found on the common buckthorn (*Rhamnus cathartica*) and on *R. alpina*.

The aecidial stage of barley rust (*P. simplex*), which attacks both wild and cultivated species of *Hordeum*, occurs on *Ornithogalum umbellatum* and less frequently on *O. narbonense*.

In discussing means of control apart from eradication of the alternative host, the importance of breeding immune varieties

and the selection of varieties suitable to the local conditions is emphasized.

Nicolas (G.). **Les rouilles du Blé à Monlon (Haute-Garonne) en 1924 et 1925.** [Wheat rusts at Monlon (Haute-Garonne) in 1924 and 1925.]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 75–82, 1926.

The author contrasts his own observations made in 1924 and 1925 on the Monlon estate (in the south-west of France) with those of other observers in different parts of the country from 1921 to 1925, as regards the influence of meteorological conditions on the development and spread of *Puccinia glumarum*, *P. triticina*, and *P. graminis* on wheat.

The dominance of *P. triticina* as compared with *P. glumarum* at Monlon in 1924 and the opposite condition in the following year is attributed to moisture and temperature fluctuations rather than to varietal resistance. Though in both cases a similar percentage of moisture on the leaves is necessary for uredospore infection, *P. glumarum* is better adapted to lower temperatures than *P. triticina*. The low incidence of the former in 1924 was probably the consequence of drought in February and early March, the subsequent rain causing only a feeble development of this rust in comparison with *P. triticina*. In 1925 February was wet and *P. glumarum* severe, while subsequent dry periods hindered *P. triticina* during the months when the temperature was more suitable for its development.

It would appear from the author's data that the average weight of grain in 1925 was lower than in 1924. This is thought to have been due to the activities of *P. glumarum* in 1925, though the dryness of June probably had some effect. In the south-west of France, where the harvest is gathered early in July, the damage caused by *P. graminis* is, as a rule, of minor importance.

The apparently contradictory fact that the yield in France in 1925 was above the average is attributed to the extended use of selected varieties.

Rust in pasture and lambing.—*New Zealand Journ. of Agric.*, xxxii, 6, p. 378, 1926.

Careful investigations by qualified veterinarians in the Hawke's Bay district of New Zealand failed to confirm the prevalent belief among farmers that rust [*Puccinia* spp.] in pasture land causes a decline in the birth-rate of lambs.

Henning (E.). **Ännu några ord om möjligheterna för en rationell utrotning av Berberisbusken.** [A few more observations on the possibilities of a rational system of eradication of Barberry bushes.]—*Landtmannen*, ix, 24, pp. 472–473, 1926.

Referring to a recent paper by Lindfors on the work of barberry [*Berberis vulgaris*] eradication in Sweden [see this *Review*, v, p. 602] the writer briefly traces the development of the campaign, from the early stages in 1894, to the present day. Proposals are made for the participation of agricultural instructors, college students, and others in the work of eradication, which should also

be utilized in the relief of unemployment. Spraying the bushes with a formalin solution (1 kg. in 75 l. of water) is recommended as a possible means of control which, if practicable, would be very economical, the treatment costing only about 1 öre [under one farthing] per bush.

KHARBUSH (S.). **Recherches cytologiques sur les Blés parasités par Puccinia glumarum.** [Cytological researches on Wheats attacked by *Puccinia glumarum.*]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 92–110, 1926.

The author, after a brief summary of the mechanical and physiological theories of susceptibility and resistance to rusts in cereals, describes certain cytological reactions observed by him in varieties of wheat differing in their degree of susceptibility to yellow rust (*Puccinia glumarum*).

The different degrees of resistance presented by varieties of the same species and even by individual plants of the same variety are attributed to a variation in the reaction of the plastidome to rust infection. Immunity is, in fact, regarded as the consequence of a rapid histolysis of the chloroplasts in the infected tissues.

In susceptible wheats, the cells and their inclusions apparently maintain, for the most part, their normal structure, but there is a copious secretion of fat from the plastids of the host tissue. This fat, which is present instead of starch in the young leaves of wheat, is liberated in considerable quantity into the cytoplasm in the cells of susceptible varieties when attacked by rust, whereas in those of resistant plants, or in cells distant from the parasite, no fat can be demonstrated in the cytoplasm. The secreted fat in the former case collects in large globules and then breaks up into fine drops which are absorbed by the hyphae of the fungus. In the resistant wheats the chloroplasts become deformed and disintegrated, without any liberation of fat, when the mycelium attacks the cells. Plasmolysis sets in and the cell contents become collected in a disorganized mass. Finally death of the cell supervenes, with a more or less complete destruction of the cell contents. In resistant wheats the vacuome is also affected and there is an accumulation of phenolic compounds in the cell sap, in the form of a metachromatic precipitation. [This paper is a condensed account of work which is more fully described in the author's 'Recherches cytologiques sur la résistance des céréales (blés) à la rouille jaune *Puccinia glumarum.*' *Thèse Fac. Sci. Paris,* 101 pp., 9 pl., 5 figs., 1926.]

PRITCHARD (E. W.). **Wheat pickles. Laboratory experiments with various pickling media.**—*Journ. Dept. Agric. South Australia,* xxix, 9, pp. 781–786, 4 figs., 1926.

The effect of various bunt (*Tilletia tritici*) disinfectants on the germinative energy and subsequent development of treated Caliph wheat seed grain was investigated both on sound and damaged grain.

With sound grain, germinated on moistened cloth and in soil, copper sulphate (1 lb. in 10 galls. for 15 mins.) had some slight detrimental effect, whilst formalin (1 lb. in 40 galls. for 15 mins.)

was slightly beneficial and copper carbonate (2 oz. per bush.) was neutral.

Similar treatments with damaged grain, however, showed that copper sulphate caused severe injury in all cases, whilst formalin caused no damage to seed germinated on cloth, but had a slightly harmful effect in soil. Copper carbonate was definitely deleterious on cloth and slightly less so in soil.

SUTTON (G. L.). **Copper powders for the prevention of ball smut in Wheat.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., iii, 2, pp. 246–253, 1926.

This is a brief account of experiments made in 1922–5 at the Chapman and Merredin Experiment Farms, Western Australia, to test the efficacy of various preparations for the control of ball smut of wheat [*Tilletia levis* and *T. tritici*]. The results of the 1922–4 experiments confirmed the efficiency of copper carbonate (2 oz. per bushel), but showed that this efficiency is lessened somewhat in cases of excessive infection. Sulphur (4 oz. per bush.) was quite unsuitable, and corona copper carbonate, containing 20·8 per cent. copper, was about as effective as copper carbonate (about 50 per cent. copper) when used at twice the rate of the latter. Dehydrated copper sulphate (2 oz. per bush.) proved efficient, but as the price of copper carbonate had fallen in 1923 to 1*s.* 2*d.* per lb. there was no need for its further investigation.

Further tests in 1925 of six commercial brands of copper carbonate (46 to 53 per cent. copper), of smutol (copper oxychloride), and of copper acetate indicated that all these substances, with the exception of the lower dose of copper acetate (1 oz. per bush.), efficiently controlled the disease, although, as the season was not favourable to smut, the results cannot be accepted as conclusive.

KROSBY (P.). **Noen spirings- og beisings forsøk med korn. Et bidrag til belysning av vår spiremetodikk.** [Some germination and steeping experiments with cereals. A contribution to the elucidation of our germination technique.]—*Meld. Norges Landbrukshøjskole*, vi, 4, pp. 241–290, 1 fig., 1 diag., 8 graphs, 1926. [German summary.]

A series of experiments [full details of which are given] was carried out at the Norwegian Agricultural College, Oslo, in 1925–6, primarily to test the relative efficacy of filter paper and sand for the germination of cereal seed. The effect on germination of treatment with germisan (30 minutes' immersion in 0·25 per cent.) or uspulun (one hour's immersion in 0·4 per cent.) was also tested in connexion with seed damaged by bad harvest weather or by infection with species of *Fusarium*, *Aspergillus*, *Mucor*, and bacteria.

The results of the experiments [presented in tabular form] showed a marked stimulus to germination and subsequent development from both the treatments, with a considerable increase of yield. These effects were particularly noticeable in the case of oats and winter crops generally. Treated seed-grain showed a higher correlation than untreated between laboratory and field germination figures, especially where the filter paper method was used.

PARISOT. **Le piétin du Blé.** [The foot rot of Wheat.]—*Comptes rendus Acad. d'Agric. de France*, xii, 20, pp. 565–569, 1926.

The results of recent experiments conducted at Rennes [Ille-et-Vilaine, Brittany] on the influence of various fertilizers on the development of foot rot of wheat [*Ophiobolus graminis* and *Leptosphaeria herpotrichoides*: see this *Review*, v, pp. 415, 416] showed that the application, two days before sowing, of superphosphates at the rate of 80 kg. per hect. reduced the amount of infection from 14·59 to 5 per cent. The corresponding figures for basic slag (80 kg.), phosphate of lime (80 kg.), and lime (1800 kg.), respectively, were 6·02, 6·25, and 7·08 per cent. On the other hand, nitrogenated sylvinit, chloro-hydrate of ammonia, urea, and nitrate of soda (each 25 kg. per hect.) increased the incidence of foot rot to 23·47, 30·52, 23·22, and 21·08 per cent., respectively.

Taking 100 as the representative figure for a healthy plant, the following are the values for an individual affected by foot rot: tillering, 91·67; fertile haulms, 84·87; weight of plant, 59·23; weight of ears, 55·18; total weight of grain, 49·28; weight of a single grain, 57·96.

It would appear from field observations that foot rot is promoted by all cultural methods tending to stimulate development beyond a certain point, such as early sowing in straight rows at a favourable depth; the use of large seed grain; dense sowing; the application of excessive quantities of nitrogenous or potassic fertilizers: and the use of certain new varieties inclining to profuse tillering and having a poor root system. Contrary methods, tending towards belated vegetation, may be counted upon to reduce the amount of infection.

[The discussion following this paper and embracing various practical aspects of the disease is reported on pp. 569–577.]

PETRI (L.). **Osservazioni sul 'mal del piede' del Frumento.** [Observations on 'foot rot' of Wheat.]—*Boll. R. Staz. Pat. Veg.*, vi, 2, pp. 174–178, 1926.

Morphological studies have shown that the foot rot of 'Ardito' wheat occurring in the neighbourhood of Rome during the spring of 1926 was caused by *Leptosphaeria herpotrichoides*. The attack was, however, limited to the autumn-sown crops, those sown in December, January, and February remaining immune. The author's observations indicate that there exists a relation between the time of sowing and the incidence of the disease, but this relation is not constant and is influenced by the soil temperature and soil moisture: if a mild temperature has been maintained throughout the winter, foot rot is liable to injure even the late-sown wheat.

Infection above soil level occurs more frequently with *Leptosphaeria* than with *Ophiobolus* [*graminis*]. The mycelium penetrates the leaf sheath at the base of the stem as observed by Gaudineau and Guyot [see this *Review*, v, p. 415].

The author's experiments show that a decrease in the normal acidity of the sap occurs in infected plants, the range for tissues already infected by *L. herpotrichoides* being P_H 7·8 to 8·0; for non-infected tissues of infected plants 6·0; and for the tissues of healthy plants 5·5 to 6·0. It is suggested that this change in reaction

represents a necessary condition for the activation of enzyme secretion by the mycelium, by means of which it can act on the cytoplasmic proteids of the hosts. It is also probable that the mere secretion of a soluble alkaline salt may determine the death of the cells before the penetration of the mycelium into the tissues actually occurs. This supposition is strengthened by the frequent intracellular course of the hyphae in recently infected tissues.

Slight plasmolysis was observed in cells of the chlorenchyma placed in contact with neutral or alkaline sap from infected tissues, but this was absent in cells exposed to the sap when rendered acid or when boiled.

The chief factor determining the efficacy of the sulphuric acid treatment in the control of cereal foot rot appears to be the date of the application, which should be before the mycelium passes from sheaths to stem, but whether the treatment further acts by increasing the acidity of the infected tissues is not known.

CURZI (M.). **La 'puntatura' delle cariossidi di Frumento e una nuova specie di Alternaria.** ['Dot' of Wheat cariopses and a new species of *Alternaria*.]—*Riv. Pat. Veg.*, xvi, 5–6, pp. 125–136, 1926.

The actual cause of the brownish-black discoloration of the scutellum of the wheat grain, of frequent occurrence in Italy, is still much disputed.

The author has recently found in association with the disease a species of *Alternaria* not hitherto recorded, and which is named *A. peglionii*. Isolations almost invariably yielded this fungus and in no case was *Cladosporium* [see this *Review*, v, p. 355] or *A. tenuis* found to be present. A full description of the cultural and morphological characters of this new species is given, together with a Latin diagnosis. It is said to differ from *A. tenuis* in its initially hyaline mycelium, short chains of conidia, and geniculate conidiophores.

The infesting mycelium does not appear to be limited solely to the teguments of the scutellum, but extends across and under the pericarp and into the grooves of the grain, frequently as far as the bearded apex. In several cases the grain showed no external discoloration, but, on examination, the inner part was found to be obviously infected.

DUCOMET (V.). **À propos de la forme écidienne de Puccinia simplex.** [On the aecidial form of *Puccinia simplex*.]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 86–91, 1926.

The author has succeeded in producing the aecidial stage of the barley rust, *Puccinia simplex*, on *Ornithogalum umbellatum* under greenhouse conditions at Grignon.

Under natural conditions, however, there is an apparent lack of relationship between the intensity of cereal rusts and the occurrence of aecidia. The author states, for example, that he has never yet seen either *Thalictrum* or *Ornithogalum* attacked in the open field, but this has no evident influence on the incidence of *P. triticina* and *P. simplex*. In a similar way, no aecidia were found on *Anchusa*, recognized as the alternate host of the rye rust, *P. dispersa*, until after the rye harvest; *Rhamnus cathartica* is also

frequently absent near oat fields badly infected by crown rust (*P. coronata*) [*P. lolii*].

According to the observations of Kühn and Eriksson with reference to the black rust of wheat (*P. graminis*), the area liable to be directly infected by the aecidial host is very limited. But in certain districts of France the generalization of the disease is noticeable over considerable areas, no doubt as a result of an extension of the primary foci, and the constitution of secondary ones, by means of uredospores. What is not yet clear is whether the absence of the aecidial host may interfere with the prolonged propagation of the fungus. The destruction of the aecidial host is without doubt to be recommended, but whether or not this is a wholly adequate means of control is questionable.

DICKSON (B. T.). **Two epimycetous fungi.**—*Trans. Roy. Soc. of Canada*, Section V, Ser. III, xx, 1, pp. 113–115, 5 figs., 1926.

The first of the two fungi discussed in this paper was obtained during the course of field experiments in Quebec on the control of oat smut (*Ustilago levis*), when collections were made of smutted heads which were completely covered with a white to pale strawberry-pink fungus. This organism, which is named *Acontium ustilaginicola* n. sp. (a diagnosis in English being given), developed freely on various media, such as potato dextrose agar. The hyphae are hyaline, septate, slender, measuring 2 to 3 μ, vaguely branching or forming synnemic strands. The sporiferous branches are normal to the hyphae, slender, 12 to 40 μ in length, and tapering to a point, on which conglutinate conidia are borne in a pellucid glomerule, containing up to 60 spores. The conidia are hyaline (pink in mass), cylindrical with rounded ends, and 1 to 1·5 by 5 to 7·5 μ. The parasitic nature of this fungus is as yet undetermined.

The second epimycetous fungus dealt with is *Hypomyces inaequalis*, which was found parasitizing *Amanita rubescens* in Quebec.

COFFMAN (F. A.), TISDALE (W. H.), & BRANDON (J. F.). **Observations on Corn smut at Akron, Colorado.**—*Journ. Amer. Soc. Agron.*, xviii, 5, pp. 403–411, 1926.

During the period 1920 to 1923, inclusive, data were obtained on some of the factors influencing the infection of maize by smut (*Ustilago zeae*) at the United States Dry-Land Field Station, Akron, Colorado.

The percentage of disease was found to vary in different seasons according to meteorological conditions. In 1921, which was characterized by scanty precipitation in May and June, followed by moderate rainfall and comparatively high temperatures, the incidence of infection was 25·5 per cent., compared with 18·54 per cent. in 1922 (moderate rainfall throughout the season and high temperatures in July and August), and 4·24 per cent. in 1923, when heavy precipitation occurred early in the season, followed by slight rainfall and low temperatures for the rest of the growing period.

The results of varietal susceptibility tests [which are presented in tabular form] showed that strains of Swadley maize grown from 1920 to 1922 showed marked differences in degree of infection, some producing consistently less smut than others [see this *Review*,

v, p. 224]. Ear-row progenies from the same parent ear-row sometimes displayed marked differences in susceptibility, while in other cases they were very similar, all strains in the latter case showing either high or low percentages of smut. These results are thought to have a practical bearing on the breeding of smut-resistant strains.

PETRI (L.). **Ricerche sulle cause del disseccamento dei Limoni in provincia di Messina.** [Researches on the causes of wither-tip of Lemons in the Province of Messina.]—*Boll. R. Staz. Pat. Veg.*, vi, 2, pp. 108–118, 2 figs., 1926.

During the last six years the lemons growing in the S. Teresa Riva area of Messina [Sicily] have been severely affected by a wither-tip disease, which attacks the buds and the tips of the twigs. The disease is first noticeable in January, reaches its maximum intensity in March, remains dormant during the summer months, and renews its activity in September and October. The drying up of the twigs gradually extends down to the larger branches and the main stem, the actual time taken before the tree dies varying from two to three years for trees 30 to 40 years old to a single vegetative period. A rounded, sunken, brown blotch may appear on the fruit, but this is not very frequent. Leaves have not been found to be directly attacked, and the roots are also unaffected and develop normally.

The only parasitic fungus found early in the disease is a *Colletotrichum*, probably *C. gloeosporioides*, but the wide distribution of this species when contrasted with the comparatively limited area in which wither-tip has damaged the trees suggests that it is not the sole agent responsible for this disease, which is regarded as one of the forms of 'mal secco', the epidemic outbreak of which on citrus and other fruit trees has recently attracted attention in Italy [see this *Review*, iii, p. 523].

The parasitic nature of *C. gloeosporioides* under certain conditions has been clearly demonstrated. Infection spreads from the top to the base within the woody tissues of the branches and then to the base of the stem. A yellowing of the branches and loss of the leaves occurs, however, before any traces of the mycelium are found in the inner tissues. The fungus does not appear to attack normally healthy trees, except on parts weakened through physiological causes. The author's inoculations of young buds and shoots of vigorous lemon trees resulted in only a limited infection, with a gummosis of the cambium which was arrested before much spread had taken place. Investigations in badly attacked orchards indicate that the principal factor predisposing lemons to infection is the lack or insufficiency of carbonate of lime in the soil.

PEYRONEL (B.). **Studio morfobiologico e sistematico di un fungo parassita dei Limoni nel Messinese (Colletotrichum gloeosporioides Penzig).** [Morphological and systematic study of a parasitic fungus on Lemon trees in Messina (*Colletotrichum gloeosporioides* Penzig).]—*Boll. R. Staz. Pat. Veg.*, vi, 2, pp. 118–134, 8 figs., 1926.

Following on Petri's investigations on wither-tip of lemons in Messina [see preceding abstract], the author made a detailed study

of the morphological characteristics of the causal fungus, and has definitely identified it as *Colletotrichum gloeosporioides*. His observations were limited to green shoots from lemon trees sent from Messina in the spring of 1925, and consequently it has not been possible to determine the limits of variability of the fungus. Abundant mycelium was found in the infected tissues, but fructifications were somewhat scarce. Pure cultures were obtained and compared with cultures of *C. gloeosporioides* isolated from leaves and branches of orange trees growing in Rome. The fungus was also compared with the material issued by Penzig in his 'Fungi agrumicoli', fasc. v. Notwithstanding the limited material to hand and its relative homogeneity, a remarkable degree of variation and a pronounced polymorphism in the conidial fructifications were found. The latter are formed in the epidermis, which is ruptured by the vertical pressure exercised by large paraphyses which develop in the young acervulus. These paraphyses are very variable in shape, being sometimes divided by septa into swollen, vesicular cells, sometimes more filamentous and branched, especially at the margins of the acervulus, and sometimes unseptate and resembling cystidia. The form and dimensions of the acervuli, setae, and conidia correspond closely to the diagnosis and specimens of *C. gloeosporioides* Penzig. The fungus was, however, limited almost exclusively to the twigs in the specimens from Messina and rarely attacked the leaves, whereas Penzig and other observers state that the disease caused by the typical *C. gloeosporioides* affects also the leaves and fruit.

The cultures from material collected on orange leaves in Rome, on which the acervuli were furnished with large vesicular paraphyses, produced acervuli deprived of setae, but the Messina cultures sometimes showed setae typical of the genus *Colletotrichum*. An ascigerous stage, which corresponded closely to *Glomerella cingulata*, developed in abundance, more particularly in the Messina cultures.

PEYRONEL (B.). **Di alcune Peronosporacee inferiori causanti alterazioni dei frutti degli Agrumi.** [On certain lower Peronosporaceae causing deterioration in Citrus fruits.]—*Boll. R. Staz. Pat. Veg.*, vi, 2, pp. 171–173, 1926.

Since 1921, a disease of lemon fruits has come to the notice of the author at the Rome Plant Pathology Station, from various parts of Italy (Viterbo, Liguria, Messina). From the affected tissues a Phycomycete was readily isolated, and was provisionally identified as a species of *Blepharospora*. A similar fungus was recognized on diseased orange fruits from Liguria and Rome.

Affected fruits show first a brown and then a dark violet coloration, commencing as circular patches on the rind and subsequently spreading irregularly. The tissues of the rind become softened, and a disagreeable odour is noticeable.

The fungus has not yet been definitely identified, but is thought to be a *Phytophthora* and to be distinct from *Pythiacystis citrophthora*. Oospores were produced in culture and the symptoms correspond closely to a lemon and orange rot produced artificially by the author by inoculations with a fungus originally identified

as *Phytophthora terrestris*, but now considered to be a species of *Blepharospora*, isolated from lupins [see below, p. 672].

CARNE (W. M.). **Exanthema. (A die-back of Orange trees.)**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., iii, 1, pp. 59–62, 4 figs., 1926.

In this paper the author describes in popular terms the exanthema disease of the orange in Western Australia, where it occurs principally on light or gravelly soils with a stiff or gravelly sub-soil [see this *Review*, iv, p. 411]. Favourable results are said to have been given by a single application of Bordeaux mixture (4–4–40) in August or September.

JOHNS (B.). **Anthracnose or black spot.**—*South African Fruit Grower*, xiii, 6, p. 165, 1 pl., 1926.

Anthracnose or black spot [*Colletotrichum gloeosporioides*] is stated to be common on oranges from the Transvaal, where it seems to be very prevalent. It lowers the market value of the fruit and reduces its keeping quality.

Good results have been obtained, in tests made by the author for the control of this disease, by the application of Bordeaux mixture (6–3½–100) at the fruit setting stage, and monthly up to a few weeks before ripening; spraying after the fruit is picked in order to destroy any spores remaining on the trees is also recommended. The burning of all affected windfalls is considered important.

BARTHOLOMEW (E. T.) & ROBBINS (W. J.). **Internal decline (endoxerosis) of Lemons. IV. The carbohydrates in the peel of healthy and endoxerotic fruits.**—*Amer. Journ. of Botany*, xiii, 6, pp. 342–354, 1926.

In continuation of the first-named writer's previous investigations [see this *Review*, v, p. 421], quantitative determinations were made of the carbohydrates, especially the pentoses and pentosans, in healthy lemons and others affected with internal decline.

The tissues used in the tests were taken from the peels of nearly mature fruit, the carbohydrates being extracted from the albedo, or white portion of the peel, by methods similar to those used by Spoehr (*Carnegie Inst. Washington Publ.* 287, 1919).

A remarkably large quantity of carbohydrate material was found to be present in the albedo of the lemon peel, from 50 to 62 per cent. of the dry matter being composed of material calculated as carbohydrates.

The polysaccharides hydrolysed by 1 per cent. HCl constitute from 24·7 to 35 per cent. of the dry weight of the tissues, the diseased fruits containing from 5 to 17 per cent. more than the healthy ones. The mono- and disaccharides, which varied between 13·5 and 34·4 per cent., are not consistently higher either in diseased or healthy tissues.

The ratio of the hexosans to the total carbohydrates was found to be always less in the diseased than in the healthy lemons of the same lot [average 0·131 against 0·279], while that of pentosans to total carbohydrates was greater [average 0·443 against 0·232], and

the ratio of pentosans to hexosans much greater [average 5·3 against 0·9] in diseased than in healthy fruit. The diseased tissues contained 39 to 63 per cent. more pentosans than the healthy ones, and the results of the writers' analyses indicate that these were formed at the expense of the hexosans.

READ (F. M.). **The storing of Lemons.**—*Journ. Dept. Agric. Victoria*, xxiv, 5, pp. 292–303, 3 figs., 1926.

The author discusses in this paper the storing and curing of lemons, the successful accomplishment of which is said to be vital to the citrus industry of Victoria.

Experiments showed that the best results were obtained with fruit picked while still green and about 2½ in. in diameter. Of the various storage treatments tried, wrapping the lemons in common tissue paper and packing the fruit in chaff proved most efficient, while in the cooler southern districts storing in sawdust without wrapping was equally effective.

The enormous annual loss due to the blue mould (*Penicillium italicum*) and green mould (*P. olivaceum*) [*P. digitatum*] might be largely eliminated by more careful handling of the fruit during picking and subsequently. The fruit should be handled quite as carefully as eggs to avoid those small injuries through which these fungi enter. In New South Wales treating the fruit with 5 per cent. borax solution at 115° F. for 5 minutes has given good results [see this *Review*, v, p. 422]. Brown rot (*Pythiacystis* [*Phytophthora*] *citrophthora*) [? or *P. hibernalis*: ibid., v, p. 296] results in a virulent form of decay, but chiefly attacks fruit that is picked too ripe. The organism is found in the soil, so lemons growing near the ground should not be picked. The disease can be controlled by dipping the lemons before storage in a formalin solution, 1 in 10,000, or in a solution of permanganate of potash, ¾lb. in 500 galls. water. The vaseline treatment of lemons [ibid., iv, p. 422] causes a physiological breakdown characterized by an orange discoloration and attributed to the interrupted respiration.

HOPKINS (J. C.). **An introductory note on two bacteria causing an internal rot of Cotton bolls.**—*Ann. of Appl. Biol.*, xiii, 2, pp. 260-265, 1926.

Two bacteria, referred to as *O*. 1 and *Y*. 3, were isolated from Durango cotton bolls grown from imported seed at St. Augustine, Trinidad, both of which were shown by inoculation experiments to be capable of producing a similar internal rot of at least five varieties, namely, Pima, Sea Island, Durango, Acala, and Lone Star. The symptoms, which begin to develop in four days after inoculation, include discoloration of the seed-coat and lint and a water soaked appearance of the internal tissues of the boll wall, extending sometimes to the exterior. Later the endosperm and cotyledons of the seed are attacked and rotted, the entire contents of the loculus becoming a soft, pulpy mass.

A species of *Colletotrichum* was associated with *O*. 1, and combined inoculation experiments with the bacterium and fungus resulted in the development of typical anthracnose spots on bolls of four varieties. Hence *O*. 1, like *Bacterium malvacearum* (*St.

Vincent Off. Gaz., 18, 1918), is capable of preceding *Colletotrichum*, but owing to its weak degree of parasitism it is not likely to prove important except in conjunction with anthracnose.

Particulars are given of the morphological and cultural characters of both organisms. The group number of *O.* 1 is 222.22235 and that of *Y.* 3, 222.11110. The latter, which forms whitish, gradually darkening colonies and grows rapidly, is thought to be of the same class as that reported from India by Ballard and Norris [see this *Review*, ii, p. 367].

LUDWIGS [K.]. **Krankheiten an Zierpflanzen.** [Diseases of ornamental plants.]—*Blumen- und Pflanzenbau*, xli, 12, pp. 176–178, 5 figs., 1926.

Brief notes are given on the following diseases of ornamental plants. A yellowish spotting, followed by shrivelling, of the flower-buds occurred on Innocence hyacinths, accompanied by a flattening and cohesion of the flower-stalks. The latter phenomenon was observed also in the Königin der Weissen variety. The condition is believed to be due to metabolic disturbances arising from excessive applications of nitrogen. Yellow rot of hyacinths (*Pseudomonas hyacinthi*) [see this *Review*, v, p. 611] and *Botrytis* [*cinerea*] on tulips were also reported. Lilies of the valley were also affected by a stunting and premature shrivelling of the blossoms, thought to be due to excessive applications of nitrogen in conjunction with the drought of 1925. *Primula obconica* and pelargoniums suffered from an obscure disease characterized by dwarfing and sometimes also by curling of the foliage.

ARENDS (G.). **Krankheitserscheinungen bei Primula obconica.** [Pathological symptoms in *Primula obconica.*]—*Blumen- und Pflanzenbau*, xli, 6, pp. 92–93, 1926.

Brief notes are given on a chlorosis of *Primula obconica* characterized by a yellow or whitish mottling of the leaves. The condition is stated to be due to soil acidity caused by artificial fertilizers or over-manuring, and may be remedied by the substitution for leaf mould of a good compost with an admixture of acid-free peat, sand, and, if necessary, clay. Two or three applications, at weekly intervals, of a solution of 0·5 gm. ferrous sulphate and 0·5 gm. sodium nitrate per litre of water have also given good results.

LAUBERT (R.). **Bemerkungen zum diesjährigen ungewöhnlichen Auftreten des Veilchenrostes.** [Observations on this year's unusual manifestation of Violet rust.]—*Die Kranke Pflanze*, iii, 6, pp. 103–105, 1 fig., 1926.

The symptoms of violet rust (*Puccinia violae*) are briefly described. Pale green, somewhat protuberant spots of variable dimensions (up to 10 mm.), covered with the orange-yellow aecidia of the fungus, are formed chiefly along the mid-rib on the under side of the leaf. Aecidia are occasionally found also on the upper side of the leaf and frequently occur in lines of 1 to 15 cm. by 0·5 to 2 mm. on the slightly swollen petioles. The writer's attempts to

transmit *P. violae* from wild to cultivated violets have been uniformly unsuccessful, suggesting the existence of two or more biologic forms of the fungus. On the wild violet the disease appears in a more conspicuous form, characterized by large spots on the leaves and malformations of the petioles and stalks, with occasional infection of the secondary leaves and sepals. There would seem to be little prospect of practical control of the disease.

AGOSTINI (ANGELA). **Osservazioni sul parassitismo e sullo sviluppo del 'Colletotrichum omnivorum' Halst.** [Observations on the parasitism and development of *Colletotrichum omnivorum* Halst.]—*Riv. Pat. Veg.*, xvi, 5–6, pp. 137–144, 1926.

Further cases of leaf disease of *Aspidistra lurida*, in which the leaves become spotted and lacerated, were observed last year at a number of localities in the province of Siena, Italy. The causal fungus, *Colletotrichum omnivorum* [see this *Review*, iv, p. 740], is said to live normally as a saprophyte in dead tissues and only in certain cases to become parasitic. It is thought to overwinter as dormant mycelium in the dead tissues of the plant.

NISHIMURA (M.). **Studies in Plasmopara halstedii. II.**—*Journ. Coll. Agric. Hokkaido Imper. Univ.* (Sapporo, Japan), xvii, 1, pp. 1–61, 5 pl., 1926.

In connexion with a cytological study of the causal organism of sunflower blight (*Plasmopara halstedii*) [see this *Review*, ii, p. 315], full details of which are given, it was observed that conidiophores may develop on the underground stem and the roots, emerging through the middle lamellae of the epidermal cells in the latter case. The conidia on these conidiophores are larger than those on the leaves.

Haustoria are developed in any cells in which nutriment is available, two or three being formed simultaneously in the same cell under favourable conditions. New haustoria are generally produced only in the growing part of the mycelium. Well-developed haustoria have short, thick necks.

Two methods of absorbing nutriment may be observed. The haustorium may penetrate the cell wall through an abnormal thickening which finally disintegrates at its apex, so that the haustorium comes into direct contact with the cytoplasm, or the haustorium may advance into the host cell without outgrowing the protective thickening of the wall, which keeps pace with its progress but finally becomes somewhat gelatinized and allows the passage of nutrient material from the cytoplasm without complete disintegration.

A plasmatic sheath is often formed round the cell wall thickening before penetration by the haustorium, and sometimes remains for a short time after this process is accomplished. This is evidently an additional protective measure on the part of the host cell.

The average dimensions of the haustoria are 4 to 10 μ in breadth and 4 to 12 μ in length, but they occasionally reach a size of 25 μ in either dimension.

TOGASHI (K.). **On a new species of Alternaria causing a leafspot disease of Gomphrena globosa L.**—*Bull. Imper. Coll. Agric. and Forestry* (Morioka, Japan), ix, pp. 1–16, 4 figs., 1926.

In August, 1924, the writer observed a peculiar leaf spot disease of *Gomphrena globosa* (Amaranthaceae) near Kyoto, Japan. The first symptom is the development of dark reddish-purple spots, gradually expanding to a maximum diameter of 8 mm., mostly on the lower and middle leaves of the plants. The colour of the spots ranges from pale smoke-grey in the centre of the dry part to acajou red (Ridgway's Color Standards) on the outer side of the surrounding border. The spots sometimes coalesce and the affected leaves wither prematurely.

The conidiophores of the fungus arise from the stomata and are generally brown, simple, amphigenous, mostly epiphyllous, 65 to 123 by 5 to 8 μ, and with one to five septa. The conidia are brown, smooth-walled, elongate-obclavate to obclavate, with long, septate beaks, and are generally borne singly at the apex of the conidiophores, or occasionally in a short chain. The conidia have 5 to 14 transverse septa, while longitudinal septation was observed only in 6·4 per cent. of those examined. The extreme dimensions of the conidia were 56 to 216 by 11 to 20 μ (average $126{\cdot}06 \pm 0.87$ by $14{\cdot}21 \pm 0{\cdot}065$ μ). The fungus is referred to the genus *Alternaria* as a new species, *A. gomphrenae*, an English diagnosis being given.

At room temperature in summer (30° C.) the conidia germinated within three hours, and in 36 hours new conidia were produced. The cultural characters of the fungus are briefly described.

No infection was obtained on *G. globosa* or other members of the Amaranthaceae by inoculation with conidia produced in culture, whereas those developing in nature caused the typical symptoms of leaf spot. The germ-tubes of the conidia on the natural host penetrated the epidermal walls directly or occasionally entered through the stomatal apertures.

ROLDAN (E. F.). **Bacterial wilt of Marigold, or Amarilla.**—*Philipp. Agric.*, xv, 1, pp. 37–40, 3 figs., 1926.

In October, 1925, a bacterial wilt of [African] marigold or amarilla (*Tagetes erecta*) was observed at the Los Baños College of Agriculture, Laguna, Philippine Islands. The general symptoms of the disease resembled those caused by *Bacterium solanacearum*, to which the organism isolated from affected plants also approximated closely in cultural, morphological, and biological characters [which are briefly described]. The Philippine organism is stated to be slightly larger than Smith's original strain, but the difference is not considered sufficient to separate the two forms. The marigold bacterium was found to be capable of infecting tomato, potato, tobacco, and castor bean (*Ricinus communis*), while a strain of the same organism from tomato also caused slight symptoms on pepper and eggplant (*Solanum melongena*) as well as on the above-mentioned hosts.

DUCOMET (V.). **Le Rhizoctone violet et ses hôtes.** [The violet *Rhizoctonia* and its hosts.]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 33–38, 1926.

The author records in this paper the results of an extended search for host plants of the violet *Rhizoctonia* [*R. crocorum*], particularly in relation to the occurrence of this disease on lucerne, which has been attacked regularly in the Lot-et-Garonne Department (France) during recent years [see this *Review*, ii, p. 371], although clover, which is very susceptible in both Germany and Denmark, was only found infected in 1925 for the first time. Apart from sugar beet, carrots, and potatoes, on which the disease occurs every year even when the land has been free from lucerne for some years, no other cultivated plants were found affected, whilst numerous weeds [a list of which is given] were more or less heavily attacked.

Excluding woody plants, the total number of hosts recorded for this fungus is stated to be 59 species, belonging to 44 genera and including 20 different families. Of these, 52 were found in the lucerne fields in question, but not less than 28 of them were immune and the others showed considerable differences in susceptibility. The possible existence of biological forms of the fungus is discussed, but the author considers it is safer at present to regard this variation in susceptibility as due to meteorological factors.

No mature basidial fructifications were discovered, although the author found sheaths of reddish-violet mycelium around the bases of plantains [*Plantago* spp.] in infected lucerne fields [see also this *Review*, iv, p. 247]. These sterile fructifications resemble *Hypochnus violaceus* of Eriksson, a name which is said to be untenable as it has previously been used for a distinct parasite of trees.

With regard to the control of the disease, it is recommended that lucerne should not be grown for more than three years consecutively, whilst cleaning of the land, deep cultivation, wider use of sainfoin [*Onobrychis sativa*] and *Lotus*, which are scarcely ever attacked, should contribute largely to check the spread of this disease.

PEYRONEL (B.). **Isolamento della 'Blepharospora' del Lupino.** [Isolation of *Blepharospora* from the Lupin.]—*Boll. R. Staz. Pat. Veg.*, vi, 2, pp. 160–161, 1926.

Since 1920, the fungus responsible for root rot of lupins (*Lupinus albus*) has been under observation in the province of Rome. It was originally identified as *Phytophthora terrestris* [*P. parasitica*], a fungus known in America to cause stem rot of lupins, buckeye rot of tomatoes, and gummosis of citrus trees. Inoculations in green tomatoes did, in fact, result in the production of symptoms corresponding exactly to those of buckeye rot. Later, however, the fungus was recognized to be a typical *Blepharospora*, and it is now under further study.

The disease is most prevalent in impermeable soils, and often occurs simultaneously with other fungi such as *Chalaropsis thielavioides* and *Pestalozzia lupini* [*Ceratophorum setosum*: see this *Review*, v, p. 391].

DELWICHE (E. J.). **Tests of strains of Red Clover from various sources.**—*Journ. Amer. Soc. Agron.*, xviii, 5, pp. 393–403, 1926.

This progress report of a test of red clover strains from various parts of the world for suitability under Wisconsin conditions contains references to the reaction of the different varieties to mildew [*Erysiphe polygoni*].

A study of the data collected indicates that foreign seed is not generally well adapted to cultivation in Wisconsin. Seed of Italian origin was particularly liable to disease, with which a high degree of winter killing is closely correlated.

OPPENHEIMER (H. R.). **Die Therapie der Baumschulkrankheiten.** [The therapy of nursery diseases of trees.]—*Angew. Bot.*, viii, 3, pp. 137–146, 1926.

The writer briefly discusses the liability of young nursery trees to diseases of a specifically juvenile character and suggests some measures for their control. Among the fungi mentioned, *Venturia dendritica* [*V. inaequalis*] and *V. pirina* [on the apple and pear, respectively] may be controlled by the application of 1 to 2 per cent. Bordeaux mixture. Apple mildew (*Podosphaera leucotricha*) and American gooseberry mildew (*Sphaerotheca mors-uvae*) require frequent applications of cosan (0·5 per cent.), as well as drastic pruning; the latter disease is stated to be amenable also to 0·5 per formalin. Oak mildew [*Microsphaera quercina*] has been found to yield to fortnightly applications of cosan. The use of sodium chloride solutions against this disease is not recommended, on account of their tendency to injure the foliage.

The destruction of infected material is the only known treatment against wood-dwelling organisms, e.g., *Stereum purpureum* on apples and plums, *Sclerotinia cinerea* on sour cherries, *Nectria cinnabarina* (the importance of which is stated to be widely underestimated), and *Verticillium albo-atrum*. The last-named fungus causes a wilt of maples (*Acer* spp.) which is probably associated with the previous cultivation of potatoes.

Gummosis of stone fruit trees, which is said to be more important than any of the above-mentioned diseases, sometimes causes heavy damage on clay soils, and has so far resisted all attempts at control. Lighter soils are to be recommended, especially for cherries.

CARDINELL (H. A.). **Fire blight can be controlled.**—*Amer. Fruit Grower*, xlvi, 2, pp. 9, 52–53, 5 figs., 1926.

Fireblight [*Bacillus amylovorus*] may attack apple, pear, or quince trees in one or more of three ways. Blossom blight, which is generally restricted to seasons with an abnormally early spring, is the most destructive of the current year's fruit crop. Twig blight is the most common form of the disease, while crown and root blight frequently passes unrecognized, which may account for frequent failures in the eradication of infection. Practical methods for the control of the disease include a systematic examination of the orchard during the early autumn, the surface soil being removed to expose the base of the upper roots for inspection; frequent dormant applications to all large wounds on the limbs, trunk, and

roots of some good preservative compound, e.g., high grade coal tar diluted with creosote oil or Barrett & Co.'s 'plastic elastigum' (which has been found especially useful in root and crown work); grafting by the so-called 'bridge' and 'approach' methods [brief notes on which are given]; and disinfection during the spring and summer with cyanide of mercury (4 gm. per pint of water) plus commercial glycerine (3 pints) [see this *Review*, iv, p. 175].

SCHUBERT (K.) & RICHTER (K.). **Studien zur Bekämpfung des Apfelmeltaues (Podosphaera leucotricha) und einiger anderer Obstbaumschädlinge pilzlicher und tierischer Art.** [Studies in the control of Apple mildew (*Podosphaera leucotricha*) and some other fungous and animal pests of fruit trees.]—*Angew. Bot.*, viii, 3, pp. 146–167, 5 figs., 1926.

The writers describe at some length a series of laboratory and field experiments in the control of apple mildew (*Podosphaera leucotricha*) and other fungous diseases by means of castor-oil potash soap emulsions of hydrocarbons with phenols [see this *Review*, v, p. 44], bases, and mixtures of hydrocarbons with phenols (all obtained from gas tar), and a preparation of tar components known as pomastin. The hydrocarbons fractioned as follows: 160° to 200° C., 25 per cent.; 200° to 250°, 50 per cent.; and 250° to 300°, 25 per cent.; the phenols distilled at 250° to 300° and the bases at 240° to 250°, respectively.

Preliminary field experiments were conducted at Buschbell, near Cologne (where the severity of the disease is stated to be steadily increasing year by year) on heavily infected 'peach-red summer apple' trees. Two hydrocarbon-phenol-soap preparations (2·54–2·46–4·0 and 2·52–2·55–4·0 per cent., respectively), gave satisfactory results in the control of the fungus, this action being attributed to the phenols in the mixture. None of the other preparations proved efficient, the bases, and the synthetic phenol-hydrocarbon mixtures causing defoliation.

Hydrocarbon and phenol preparations were also tested in the laboratory for their action on the spores of *P. leucotricha*, *Fusicladium dendriticum* [*Venturia inaequalis*], *Monilia* [*Sclerotinia*] *fructigena*, and the highly resistant *Botrytis cinerea*. The hydrocarbons exerted, at the most, a repressive action on germination, but the high boiling phenols (230° to 320°) were found to possess fungicidal properties of varying degree. The *dosis letalis* of the phenols boiling at 270° to 275° C. for *S. fructigena* was 0·033 per cent. (ten minutes' immersion); for *B. cinerea*, 0·16 per cent. (five minutes' immersion); for *P. leucotricha*, 0·025 per cent. (fifteen minutes' immersion); and for *V. inaequalis*, 0·05 per cent. (fifteen minutes' immersion). The low boiling phenols (up to 230°) gave much less favourable results, the 0·33 per cent. solution of one with a boiling point of 200°, for instance, requiring twenty minutes' immersion to produce a retardation of growth in *B. cinerea* similar to that accomplished by a 0·1 per cent. solution of a high boiling phenol in five minutes. Neither *B. cinerea* nor *S. fructigena* was killed after forty minutes' immersion in the low boiling phenol at 0·33 per cent.

Completely satisfactory results were obtained in all field experi-

ments with pomastin at a concentration of 2·5 per cent. In one plot, previously heavily infected, 50 per cent. of the treated trees (peach-red and Schlösser's Grünling) were entirely free from mildew, while in the other cases the infected shoots had died off and been replaced by fresh, healthy ones. The treatment should be applied in January or February at the latest, in order to obviate all risk of damage to the buds. Success is stated to be further largely dependent on the thoroughness of the applications and the choice of suitable weather conditions (absence of wind and direct sunshine).

Excellent results were also given during the summer in the control of *Fusicladium* on pears [*V. pirina*], rose mildew [*Sphaerotheca pannosa*], and American gooseberry mildew [*S. mors-uvae*], with a phenol preparation known as pomastin S (0·5 per cent., containing 0·25 per cent. of the effective principle). In laboratory experiments spores of *P. leucotricha* and *V. inaequalis* were destroyed by fifteen minutes' immersion at 0·025 and 0·05 per cent., respectively.

The paper concludes with a brief discussion of the fungicidal action of the phenols, which are considered likely to prove of great importance in plant protection.

Powdery mildew. Results of experiments.—*Fruit World of Australasia*, xxvii, 5, p. 221, 1926.

In this paper [which follows a reprint of the report by P. H. Thomas: see this *Review*, iii, p. 722] the Tasmanian Government Assistant Fruit Expert describes the results of comparative experiments with atomic sulphur (1 lb. in 10 galls. water) and iron sulphide (1 gall. lime-sulphur 27° Beaumé, $2\frac{1}{2}$ lb. sulphate of iron, 40 galls. water) for the control of powdery mildew of the apple [*Podosphaera oxyacanthae*]. Applications were made at the 'delayed dormant' period and at the 'calyx stage'.

Both treatments resulted in a reduction of the mildew, but very little difference could be discerned between the treated plots. At the calyx stage the controls showed 6 to 8 per cent. more affected shoots than the sprayed trees, and the second spraying appeared to check the disease almost completely. The iron sulphide plots had a slightly better quality foliage throughout the season, but the final results showed that atomic sulphur gave slightly better control.

Zeller (S. M.). **European canker of pomaceous fruit trees.**—*Oregon Agric. Exper. Stat. Bull.* 222, 52 pp., 23 figs., 1 map, 1926.

A very comprehensive account is given of the symptoms, morphology, physiology, and pathogenicity of European canker of apple and pear trees (*Nectria galligena*), with special reference to western Oregon conditions.

A study of the life-history of the fungus in relation to seasonal conditions showed that the macroconidia (*Cylindrocarpon mali*) are liberated from the first autumn rains until December or early January, and again from early to late spring. Ascospore discharge occurs over a period of about 90 days between autumn and late spring. The majority of infections have been found to occur during the autumn through fresh leaf scars, and to some extent

through wounds, such as those inflicted by the woolly aphis (*Eriosoma lanigera* and *E. pyricola*), which also aids in the dissemination of the spores.

The optimum hydrogen-ion concentration for the growth of the fungus was found to be P_H 4·2 to 5·2, which corresponds to that of the sap of apple and pear bark (4·2 to 5·0 and 4·4 to 4·8, respectively). The optimum temperature for growth was provisionally placed at 18° to 24° C.

New infections may be controlled by one application of Bordeaux mixture (4–4–50) as late as practicable. Other measures for the eradication of the disease include orchard sanitation, excision of cankers, and the treatment of wounds with Bordeaux paint, made by stirring linseed oil into powdered Bordeaux.

The most susceptible varieties of apple in Oregon are Northern Spy and Winter Banana; and of pears, Anjou, Bosc, Howell, Surprise, and Old Home.

The taxonomy of the causal organism is discussed and a bibliography of sixty titles appended.

Plagge (H. H.) & Maney (T. J.). **Cold storage investigations with Wealthy Apples. Fifth Progress Report.**—*Iowa Agri. Exper. Stat. Bull.* 230, pp. 59–72, 7 figs., 3 graphs, 1925. [Received August, 1926.]

In continuation of their previous investigations [see this *Review*, iv, p. 676], the writers carried out a further series of cold storage experiments with Wealthy apples from Charles City, Iowa. The fruit was packed in standard commercial bushel baskets and subjected to a total of sixty different conditions, including combinations of (*a*) maturity at picking time; (*b*) delay in storing; (*c*) percentage of total area of each apple showing red colour; (*d*) use of oiled paper wraps; and (*e*) the cold storage period. The dates of picking ranged from 27th August to 11th September, and the fruit was stored at 32° F. with a relative humidity of 80 to 85 per cent.

Scald occurred only on the apples picked on the earliest date and stored immediately. It may be concluded, therefore, that this disease is closely correlated with immaturity at picking time. Oiled wraps were very effective in preventing this disturbance, the incidence of which on immature fruit was reduced by their use from 33·5 to 5 per cent. Of the immature, unwrapped apples exposed to a temperature of 70° for five days, 90 per cent. developed scald, which did not occur at all in wrapped fruit under similar conditions.

Early picking combined with delayed storage was found to induce soft scald, as was also the case with Jonathans [loc. cit.]. This disease was practically eliminated by the immediate storage of either immature or mature fruit. Oiled wraps were not uniformly successful in the prevention of soft scald.

The quantity of apples affected by rots from skin injuries amounted to 11 per cent.

Carne (W. M.). **Crinkle of Japanese Plums.**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., iii, 2, p. 175, 1 fig., 1926.

In this brief note the occurrence is recorded in several localities of Western Australia of a diseased condition of the fruit of Japanese

plums [? *Prunus salicina*], characterized by the presence of dark, hard, depressed, irregular areas which may cover over one half of the fruit. The surface of these areas is much pitted or wrinkled. Usually only a few fruits are affected, but in bad cases, particularly with the Kelsey variety, the trouble may extend to a considerable portion of the crop. The disease is stated to be associated with high temperatures and drying winds, especially where the soil tends to be on the dry side. The only control measure recommended is the replacement of the very susceptible Kelsey variety by more resistant ones.

GUYOT (L.). **Essais de lutte pratique contre la chlorose du Pêcher.** [Trials for the practical control of chlorosis of the Peach.]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 66–69, 1926.

Peach trees in the Rhone valley are stated to be suffering severely from chlorosis, the cause of which has not yet been clearly ascertained.

Spraying experiments conducted at Guilherand-les-Saint-Péray (Ardèche) in 1923 and 1924 demonstrated the possibility of temporary control of the disease by the application of iron sulphate solution. The leaves of trees treated, after pruning in November, with solutions of 15, 20, and 40 per cent. strength retained their colour throughout the summer and on the 1st July the green foliage contrasted remarkably with the chlorotic appearance of the leaves on the neighbouring trees. In some cases fruit was produced on trees which had borne none for several years. A similar treatment the following year gave the same results, but it was found that the effect is not maintained during the second year after treatment. The use of a solution containing at least 20 per cent. iron salts is advocated. This method of control, which is both simple and inexpensive, should be applied each year throughout the orchard and not only to isolated trees. The addition of an effective fungicide to the iron sulphate solution for the simultaneous control of chlorosis, leaf curl [*Taphrina deformans*], and possibly *Coryneum* [*beijerinckii*] may also prove practicable.

Cherry leaf spot.—*New Jersey Agric. Exper. Stat. Circ.* 191, 2 pp., 1 fig., 1926.

Leaf spot of cherries [*Coccomyces hiemalis*], which sometimes causes considerable damage in New Jersey, may be controlled by clean cultivation and by the following spray schedule: dry-mix sulphur-lime (8–4–50) [see this *Review*, v, p. 311] for the petal fall spray and also when the fruit is the size of small peas; lime-sulphur, 1 in 40, (*a*) shortly after picking, (*b*) a fortnight later, and (*c*) three weeks after (*b*).

NATTRASS (R. M.). **Experiments on the control of American Gooseberry mildew.**—*Ann. Rept. Agric. & Hort. Res. Stat., Long Ashton, Bristol, for 1925*, pp. 102–104, 1926.

Spraying trials for the control of gooseberry mildew [*Sphaerotheca mors-uvae*] were carried out on a plantation of Whinham's Industry at Cheltenham in 1925 with the following fungicides

made up with 100 galls. of water in each case: (*a*) 4 pints ammonium polysulphide, 5 lb. soft soap; (*b*) 10 pints soda-sulphur compound with soft soap; (*c*) 19 lb. washing soda, 11 lb. soft soap; and (*d*) Burgundy mixture 15–34–100.

Two applications were given, the first on 28th April, just after the setting of the flowers, and the second on 5th June, except in the case of Burgundy mixture, where only the second spray was given. The resulting percentages, by weight, of mildewed fruit picked on 23rd–25th June were 4·2, 2·2, 4·5, and 22·3, respectively, whilst the control gave 43·7 per cent.

[This paper is reproduced in *Journ. Min. Agric.*, xxxiii, 3, pp. 265–268, 1926.]

BRITON-JONES (H. R.). **A note on the leaf spot disease of Black Currants.**—*Ann. Rept. Agric. & Hort. Res. Stat., Long Ashton, Bristol, for 1925*, pp. 105–108, 1926.

The defoliation of black currant bushes from the leaf spotting fungus, *Pseudopeziza ribis* is common throughout the western counties of England, and is especially prevalent on the variety Baldwin. The author considers that this is due to the fact that Baldwin is a weak grower and heavy cropper, and states that bushes which are pruned hard and manured freely, so encouraging strong growth, do not become seriously affected with this disease. He is of opinion that the frequent sprayings recommended in the United States against leaf spot are impracticable in England, and that hard pruning, with liberal manuring, may offer a satisfactory method of control.

ASHBY (S. F.). **A wilt disease of Bananas.**—*Trop. Agriculture*, iii, 6, pp. 127–129, 1926.

In December, 1925, the writer's attention was drawn to the presence near Sangre Grande, Trinidad, of a bacterial disease of Giant bananas agreeing in every respect with that described by Rorer (*Proc. Trinidad Agric. Soc.*, x, p. 109, 1910; *Phytopath.*, i, p. 45, 1911). The organism isolated from the dirty white or brown alkaline exudate from the infected vascular bundles was a short rod, often in pairs, measuring 1·5 by 0·5 μ and showing polar staining in smears and motility in young broth cultures. On steamed potato slabs the growth turned from dirty white to jet black. The organism was also isolated from plants of the Red Fig variety. Positive results were given by inoculation experiments on the Gros Michel and Sucrier varieties, while attempts to produce the disease on Giant and Red Fig bananas failed. In the successful cases the organism was recovered from the vascular bundles of the pseudostems and bulbs. Its morphological and cultural characters, so far as they have been ascertained, agree with those of *Bacterium solanacearum*, and inoculations on tomato and tobacco seedlings produced symptoms identical with those recorded for the wilt caused by this bacterium. The virulence of the pathogen towards tomato and tobacco plants was found to be enhanced by passage through those hosts.

The results of these investigations are thought to justify the conclusion that *Bact. solanacearum* is the causal agent of bacterial

wilt of the banana in Trinidad. Infection probably came from the soil, since plots planted elsewhere in the island from the same batch of Grenada suckers remained healthy. The external symptoms of the disease resemble those of Panama disease (*Fusarium cubense*) [see this *Review*, v, p. 111], but the absence of exudate and the dull crimson discoloration of the vascular bundles in the latter case should serve as distinguishing characters, while varietal susceptibility to the two diseases also differs.

The writer comments on the apparent immunity of bananas from bacterial wilt in Sumatra, where the host range of *Bact. solanacearum* is very extensive [see this *Review*, iii, p. 107].

The Melon blights.—*New Jersey Agric. Exper. Stat. Circ.* 194, 2 pp. 1926.

Brief popular descriptions are given of the following diseases of melons: *Macrosporium* leaf blight [*M. cucumerinum*: see this *Review*, iii, p. 49], the causal organism of which is thought to retain its viability possibly for a year in the soil; anthracnose [*Colletotrichum lagenarium*]; scab [*Cladosporium cucumerinum*] which is less severe than anthracnose in New Jersey; downy mildew [*Pseudoperonospora cubensis*]; and bacterial wilt [*Bacillus tracheiphilus*; see this *Review*, i, p. 327].

In addition to the ordinary cultural measures, seed disinfection by five minutes' immersion in corrosive sublimate ($\frac{1}{4}$ oz. in 2 galls. water), followed by thorough rinsing, is recommended for the control of the three first-named diseases. This treatment may be supplemented by regular applications of 3–4–50 Bordeaux mixture or copper-lime dust.

DEL CAÑIZO (J.). **La tuberculosis del Olivo.** [The Olive knot disease.]—*Bol. Estac. Pat. Veg.*, i, 2, pp. 67–69, 2 figs., 1926.

The olive knot disease caused by *Bacterium* [*Pseudomonas*] *savastanoi* is stated to be very prevalent in Spain, constituting a serious menace to the olive groves in many districts. Excessive soil humidity and inadequate use of nitrogenous manures are considered to predispose the trees to attack, while hail and late frosts produce injuries which permit the entry of the causal agent [see this *Review*, ii, p. 415]. Certain varieties have been observed to show resistance.

Control measures are based solely on plant sanitation and cultural methods, including careful pruning and selection of grafts; burning of prunings; application of farmyard or green manure and phosphatic or potassic fertilizers sufficient to render the soil slightly acid; and, in the earlier stages of the disease, the excision of large tumours and the disinfection of the wounds with ferrous sulphate or phenol, with a subsequent coating of tar or paste. A mixture consisting of wax, vaseline, and fat (500–500–50) at a temperature of 50° to 60° C., has proved effective as a wound dressing, whilst another composed of yellow wax, turpentine, pitch, and fat (500–500–250–100) is also recommended for application at ordinary temperatures.

Brown spot of Passion fruit.—*Fruit World of Australasia,* xxvii, 6, p. 289, 1926.

Brown spot of passion fruit [*Passiflora edulis*], which is caused by *Gloeosporium fructigenum* [*Glomerella cingulata*], first appears on the leaves in the shape of small, circular, brown spots, surrounded by a dark green (later dark brown) border. Small white or greyish spots usually develop in the centre of the dead tissue, which in advanced stages may be considerably cracked. Elongated, discoloured spots found on the stem may develop into cankers exposing the underlying woody tissues, and in some cases the laterals are completely girdled. Affected shoots wither and ultimately die back. The fruits first develop small, sunken, brown spots with concentric markings; subsequently the skin assumes a texture like parchment and the fruits shrivel and drop. Wide spacing, thorough ventilation, and the removal of infected material are recommended for the control of the disease.

PEYRONEL (B.). **Ricerche sull'azione anticrittogamica dei concimi chimici.** [Investigations on the anticryptogamic action of chemical fertilizers.]—*Boll. R. Staz. Pat. Veg.*, vi, 2, pp. 138–144, 1926.

Soil sterilization has been shown to have a marked effect in counteracting the injurious effects of root fungi, soil protozoa, and bacteria, but its prohibitive cost on a large scale has led the author to investigate the antiseptic properties of certain cheap chemical fertilizers. Experiments with calcium cyanamide were made at the Plant Pathology Station, Rome, in order to determine its effect on bacteria and fungi at different concentrations. A solution of 10 per cent. of this compound was added to carrot agar in quantities such as to give concentrations of 1 in 100, 2 in 100, 1 in 1,000, and 1 in 10,000. The media were exposed to atmospheric contamination for five minutes.

The tabulated results indicate that 1 per cent. calcium cyanamide is effective in inhibiting the growth of fungi, yeasts, and bacteria; a small number developed in 1 in 1,000; and there was a considerable increase in the number of colonies as compared with the control in a concentration of 1 in 10,000.

Experiments were also conducted to ascertain whether calcium cyanamide could be used as an effective seed disinfectant without injuring germination. Immersion of wheat seed grain in a 1 in 10,000 solution for 14 hours resulted in no appreciable damage to the embryo, but the fungicidal action was insignificant. Treatment with a 1 in 1,000 and still more so with a 1 in 100 solution can, if prolonged, seriously injure germination and seedling development when the seed is germinated on damp paper or on the surface of damp sand, but this effect was either neutralized or markedly diminished if the seeds were sown beneath the sand or in damp soil. Such concentrations have a definitely fungicidal effect. Seed treated with 5 per mille by weight of dry calcium cyanamide and then sown in soil germinated normally if the soil received water immediately after sowing: but only 88 per cent. (compared with 95 per cent. in the control) germinated normally if watering was delayed for 48

hours, a further 6 per cent. germinating later on but giving dwarfed seedlings. At 3 per mille the dry treatment permitted normal germination.

PETRI (L.). **Azione tossica della calciocianamide sulla Blepharospora cambivora e la Pythiacystis citrophthora.** [The toxicity of calcium cyanamide to *Blepharospora cambivora* and *Pythiacystis citrophthora.*]—*Boll. R. Staz. Pat. Veg.*, vi, 2, pp. 135–138, 1926.

In view of a proposal made by Voglino at the Phytopathological Observatory, Turin, that calcium cyanamide should be used as a preventive of ink disease of chestnuts, the author carried out a series of experiments to test the effect of this compound on the development in culture of the causal organism (*Blepharospora cambivora*) and also of *Pythiacystis citrophthora.*

The results obtained indicate that a concentration of 1 per mille, used alone or with mineral salts, checks mycelial development in both fungi. *B. cambivora* did not develop in soil from chestnut groves which received applications of 2 and 1·5 per mille, but 0·5 per mille did not reduce its growth nor that of *P. citrophthora*, which formed abundant zoosporangia. One per mille inhibits growth in both fungi but does not kill them, since the mycelium resumes its normal development if transferred to a non-toxic nutrient substratum.

The author concludes that calcium cyanamide may act as an effective preventive of ink disease of chestnuts exposed to infection. An application of one to two kg. per full-grown tree is recommended, the fertilizer being spread around the base of the tree for a distance of three or four metres. Citrus trees are so sensitive to the toxic action of calcium cyanamide that this substance cannot be recommended for the control of the foot rot due to *P. citrophthora* and allied organisms to which they are subject.

RAVAGLIOLI (T.). **Solfato di rame o pasta Caffaro ?** [Copper sulphate or Caffaro paste ?]—*L'Istria Agric.*, vi, 11, pp. 268–269, 1926.

In discussing the use of Caffaro paste in preference to copper sulphate, the author states that he considers Caffaro powder (the paste reduced to a fine powder) equal to Bordeaux mixture (containing 1 per cent. copper sulphate) in efficiency, having used it against vine diseases on 1,200 hectares, for many years, with excellent results [see also this *Review*, i, p. 66]. Caffaro powder, moreover, presents the advantage of being cheap, and is so easy to prepare that it can be done by boys; it gives a standard product neither too acid nor too alkaline, and does not require the use of lime.

UPPAL (B. N.). **Toxicity of organic compounds to the spores of Phytophthora colocasiae Rac.**—*Journ. Agric. Res.*, xxxii, 11, pp. 1069–1097, 1926.

The investigation reported in the present paper was undertaken to ascertain whether there is any relationship between the chemical constitution of certain organic compounds and their physiological

action on the germination of fungal spores. The compounds selected were alcohols, aldehydes, and organic acids, and these were tested on *Phytophthora colocasiae,* chosen because it makes a fairly rapid growth on oatmeal agar and produces sporangia in abundance. The occurrence or failure of germination after periods of six and eighteen hours was found to be the best index of the effect of the various compounds on the sporangia.

The results of the toxicity trials of aliphatic alcohols tend to confirm Richardson's law that the toxicity of the normal aliphatic alcohols increases in proportion to their molecular weight. The isomeric aliphatic alcohols were found to be less toxic than the corresponding normal alcohols. Normal butyl, isobutyl, secondary butyl, and tertiary butyl alcohols decreased in toxicity in the order given. Allyl alcohol was the most toxic of the alcohols investigated, its high toxicity being probably due to the allyl radical whilst the presence of a double bond is also believed to have an accentuating influence. Ethylene glycol and glycerol were not very toxic, being the lowest members of the homologous series in this respect. Benzyl alcohol and furfuralcohol were found to be 31 times more toxic than ethyl alcohol, probably owing to the benzene nucleus and the presence of the unsaturated oxygen atom in the furyl radical, respectively.

The toxicity of aldehydes is due mostly to the aldehyde group which they contain, while the aromatic or the aliphatic nature of a radical to which the aldehyde group is united appears to have very little influence. Unlike the normal aliphatic alcohols, the toxicity of aldehydes did not increase as the homologous series was ascended. The increased toxicity of formaldehyde corresponded with anomalies observed in regard to its chemical and physical properties. It is possible that the presence in formaldehyde of a hydrogen atom which is very sensitive to oxygen may have an accelerating influence on its toxicity. Glyoxal was much more toxic than any other aldehyde tested, excepting formaldehyde and the substituted benzaldehydes, its high toxicity probably being due to the toxic value of the two aldehyde groups it contains. The substitution of a nitro or a hydroxyl group in benzaldehyde increased its toxicity many times, but the substitution of two hydroxyl groups did not produce any further increase in toxicity. The hydroxybenzaldehydes were more toxic than the nitrobenzaldehydes.

The result of the toxicity trials of organic acids indicated that the electrolytic dissociation of an organic acid is not always an index of its physiological action, for in these acids the undissociated molecules and the anions had a distinct toxic action of their own. In general, the ordinary isomeric acids had very nearly the same toxicity and in a homologous series the lower members were stronger. The introduction of a halogen into acetic acid enormously increased its dissociation, and consequently, though to a lesser extent, its physiological action. The introduction of a hydroxyl group into acetic and propionic acids increased their electrical conductivity, with a consequent increase in their toxic action. Stereoisomerism, as illustrated by maleic and fumaric acids, had a marked influence on physiological action, fumaric acid (*trans* form), which has a lower dissociation than maleic acid (*cis*

form), being more toxic than the latter. The nature of a substituent in an aromatic acid and its position relative to the carboxyl group generally determine the toxic action of the acid. A hydroxyl or a nitro group in benzoic acid increased the dissociation constant of the acid, with a consequent increase in toxicity. However, in the case of indirect germination, an increase in the dissociation constant of the acid was not always accompanied by an increase in its toxicity. A double bond led to an increased physiological action of the acid, as in cinnamic acid. The presence of an animo group lowered the toxicity of sulphanilic acid.

LANDGRAF (T.). **Kohlensäurebegasung als Bekämpfungsmittel von Traubenschimmel und Vermehrungspilz.** [Fumigation with carbonic acid for the control of grey mould and the propagation fungus.]—*Gartenwelt*, xxx, 23, pp. 359–360, 1926.

Excellent control of grey mould (*Botrytis cinerea*) and the propagation fungus (*Moniliopsis aderholdi*), which cause heavy damage to ferns in the autumn and to a number of ornamental plants in the spring, was obtained in a preliminary experiment by fumigation of the greenhouse with carbonic acid gas. Good results were also given by the application of coal dust to the soil. Particular importance is attached to these observations, since all the usual sanitary measures have proved totally ineffectual against the organisms in question.

GÄUMANN (E.). **Vergleichende Morphologie der Pilze.** [Comparative morphology of the fungi.]—x+626 pp., 398 figs., Jena, Gustav Fischer, 1926.

The object of this work is stated to be the application of data obtained from cytological studies to the interpretation of the problems of comparative morphology in the fungi. The first part comprises sections on general morphology, including vegetative bodies, organs of fructification, and the reproductive system; while the second and main part deals with the morphology of the four classes of fungi, viz., Archimycetes, Phycomycetes, Ascomycetes, and Basidiomycetes, a few pages dealing with the Fungi Imperfecti being added. This part also contains a retrospect on the taxonomy of the fungi. The method of classification of the 29 groups discussed in the text is demonstrated by a phylogenetic tree based on the conjecturally more important morphological and cytological relationships. Copious references to literature, especially to papers containing detailed bibliographical accounts of earlier work, add much to the value of this important work.

ARNAUDI (C.). **Sull' immunità acquisita nei vegetali.** [On acquired immunity in plants.]—*Atti Soc. Ital. Sci. Nat. (Milan)*, lxiv, 3–4, pp. 230–238, 1926.

Sterilized potato disks were immersed in attenuated cultures of an organism, belonging to the *Bacillus mesentericus* group, which is normally highly pathogenic to potato tubers. Two of the five disks subsequently inoculated with a virulent strain of the organism developed almost as severe infection as the controls, while the

remaining three showed only small, dry lesions very different from the characteristic wet rot ordinarily produced by the bacillus.

In a second series of experiments, geranium shoots were inoculated with *B[acterium] tumefaciens* three or four cm. above existing tumours, the result of previous inoculations with the same organism. The inoculation wounds healed rapidly and no tumours were produced, whereas control plants inoculated for the first time developed tumours as large as a hazel-nut in six weeks.

Inoculation of rabbits with increasing doses of *Bact. tumefaciens* resulted in the production of an agglutinating serum for the same organism, and branches made to absorb this were with difficulty infected.

Though insufficient to permit of definite conclusions, these data are regarded as indicating the existence of acquired immunity in plants.

DUFRÉNOY (J.). **Mycocécidies observées dans la vallée de Barèges.** [Mycocecidia observed in the Barèges valley.]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 51–65, 14 figs., 1926.

This paper contains observations on mycocecidia occurring in the Barèges valley [French Pyrenees].

Leaf galls of *Veronica fruticulosa* are induced by a *Gloeosporium*, probably *G. veronicarum*.

The prolonged retention of chlorophyll round the infected point has been seen on leaves of *Asphodelus subalpinum* attacked by *Puccinia asphodeli*, the sori being outlined very clearly by a green ring on the otherwise discoloured leaf.

Mycocecidia formed in chlorophyllous tissue are, unless coloured by anthocyanin, generally pale. For example, the galls of *Protomyces macrosporus* on *Meum athamanticum* and of *P. kreuthensis* on *Prenanthes purpurea* present a whitish appearance. Chloroplasts are absent from the fundamental tissue of the galls in these cases.

The fate of the chloroplasts in individual plants of the same species attacked by the same rust may differ, and this appears to be true also in regard to the formation of a mycocecidium under the influence of a parasitic fungus. In the Lienz forest, the leaves of certain plants in a patch of *Galium vernum* infected by *Puccinia valantiae* were covered with teleutospores, while in other plants only spots, without sori, were formed. Similarly *Trifolium montanum* attacked by *Uromyces minor* sometimes showed leaf spotting only, sometimes bore sori, and sometimes formed mycocecidia with aecidia on the petioles.

Der Pflanzenschutz auf der Wanderausstellung der Deutschen Landwirtschafts-Gesellschaft in Breslau. [Plant protection at the travelling exhibition of the German Agricultural Association at Breslau.]—*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, vi, 6, p. 43, 1926.

The phytopathological activities to be represented at the annual travelling exhibition of the German Agricultural Association at Breslau (Silesia), under the joint auspices of the Biologische Reichsanstalt (Berlin-Dahlem) and the Breslau plant protection centre, include the following groups. (1) Pests and diseases of root crops

(of great importance under Silesian conditions) with special reference to potato wart [*Synchytrium endobioticum*], beet diseases, and the like, which will be illustrated by new coloured posters. (2) Pests and diseases of fruit trees. (3) Testing of disinfectants, in connexion with which a display of the various appliances for the treatment of cereal diseases will be given.

BAYLISS ELLIOTT (JESSIE S.). **Concerning 'fairy rings' in pastures.**—*Ann. of Appl. Biol.*, xiii, 2, pp. 277–288, 1 diag., 1926.

Three types of 'fairy rings' occur in pastures and lawns, in England. One of these types is produced by certain species of fungi which kill or severely injure the grass by means of a toxic excretion, notably *Marasmius oreades*. The rings formed by this organism are composed of three zones, namely, (1) an inner zone with deep green and very luxuriant grass, surrounded by (2) a dry zone of dying or dead grass; and (3) a narrow outer zone of stimulated grass. Sods of the middle zone are permeated with hyphae to the depth of one foot, and microscopic examination shows the mycelium penetrating the roots of the grass and entirely consuming the soft parenchymatous cortical parts. The author considers that the death of the grass is due to parasitic action and disagrees with Shanz and Piemeisel (*Journ. Agric. Res.*, xl, 1917), who are of opinion that in a ring of this type, it is occasioned by drought produced by the presence of mycelium in the soil. *Clytocybe gigantea* and *Tricholoma gambosum* have been observed to cause similar effects to *M. oreades* in England.

SCHWARZ (M. BEATRICE). **Instervingsverschijnselen bij Lochnera rosea, veroorzaakt door Phytophthora spec.** [Symptoms of die-back in *Lochnera rosea* caused by *Phytophthora* sp.]—*Indische Culturen* (*Teysmannia*), xi, 11, pp. 288–290, 3 figs., 1926.

Lochnera rosea at Buitenzorg (Java) is stated to be attacked by a stem blight caused by a species of *Phytophthora* (probably *P. faberi*).

Irregular, damp, rotted areas develop on the young fruits and leaves, and gradually the decay spreads to the stem, which may collapse if attacked near the top. The diseased foliage falls, leaving small spots on the stem at the point of attachment.

Secondary fungi rapidly develop on diseased *Lochnera* plants, the most prominent being a species of *Gloeosporium* which produces a black discoloration of the affected parts and was formerly believed to be responsible for the symptoms now ascribed to *Phytophthora*. Other secondary organisms are species of *Colletotrichum*, *Fusarium*, and *Choanephora*.

Brief notes are given on the mode of isolation and cultural characters of *Phytophthora* and *Gloeosporium*. Inoculation experiments with the former organism on wounded and unwounded *Lochnera* seedlings gave positive results, while the latter developed only on plants already infected by *Phytophthora*.

Excellent control was given by three applications a week of 2 per cent. Bordeaux mixture.

JONES (P. M.). **Structure and cultural history of a mycetozoan found in Tobacco plants with mosaic-like symptoms.**—*Bot. Gaz.*, lxxxi, 4, pp. 446–459, 4 pl., 2 diags., 1926.

This is a more detailed account of the mycetozoan found in mosaic tobacco plants and provisionally referred to the genus *Plasmodiophora* as *P. tabaci* than that already cited from another source [see this *Review*, v, p. 454].

The organism detected in the stained and fixed tissues of some 25 diseased plants extends from cell to cell by its pseudopodia. It may lie near the cell wall or round the nucleus or the chloroplasts, the disintegration of which is apparently the first visible response of the cell to the presence of the organism.

Cultural work with *P. tabaci* is stated to be still in the preliminary stages. Amoebae of the 'limax' type and flagellates developed when pieces of the diseased plants were placed in Knop's solution, but so far it has been impossible to avoid bacterial contamination. The plasmodia are stated not to occur in healthy plants nor were the organisms obtained in cultures from such plants. Inoculations of healthy plants with cultures of *P. tabaci* resulted in the typical symptoms of the disease, and the organism was recovered from the infected tissues. However, since it was not feasible to obtain pure cultures, the possibility of contamination with a virus is not excluded.

The amoebae and flagellates in Knop's solution become encysted under certain cultural and environmental conditions. Each cyst subsequently develops into an amoeboid organism. A number of these may fuse to form a plasmodium, which in turn gives rise to free spores; the latter, after encysting, again produce amoebae of the 'limax' type. The amoebae divide by binary fission or, in old cultures, form flagellate gametes, which apparently conjugate in pairs. A direct change from the amoeboid to the flagellate stage and vice versa is also stated to occur. Both the flagellates thus formed and those arising from the fusion of the gametes are capable of binary fission.

Amoebae and flagellates differing somewhat in shape and size from those occurring in tobacco tissues were cultured in Knop's solution from mosaic tomato and leaf roll potato plants, as well as from the intestinal tract of aphids feeding on mosaic tobacco and tomato, and on leaf roll potato plants.

NEUWEILER (E.). **Die wichtigsten Kartoffelsorten in der Schweiz und ihre häufigsten Krankheiten. Ein Führer bei der Feldbesichtigung.** [The most important Potato varieties in Switzerland and their most common diseases. A guide for field inspection.]—Vereinigung Schweiz. Versuchs- u. Vermittelungsstellen für Saatkartoffel, Bruck, 1925. [Abs. in *Centralbl. für Bakt.*, Ab. 2, lxvii, 16–24, p. 438, 1926.]

This field guide is stated to present information facilitating the identification of the most important potato varieties cultivated in Switzerland, and to contain descriptions of the chief diseases attacking them. Notes are given on the characteristics, origin, and resistance to wart disease [*Synchytrium endobioticum*] and *Phytophthora infestans* of 199 varieties.

ROACH (W. A.) & BRIERLEY (W. B.). **Further experiments on the use of sulphur in relation to wart disease of Potatoes.**—*Ann. of Appl. Biol.*, xiii, 2, pp. 301–307, 1926.

This paper gives a full account of the authors' experiments, carried out in 1925, on the control of wart disease of potatoes (*Synchytrium endobioticum*), a preliminary report of which has already been noticed [see this *Review*, v, p. 249].

It is stated that plots of land at Ormskirk [Lancashire] which in 1924 received applications of sulphur up to one ton per acre were dressed with lime and planted with Majestic (immune) potatoes in 1925. No adverse effect of the previous treatment was apparent in the crop.

SALMON (E. S.) & WARE (W. M.). **Note on the occurrence of diseased shoots arising from Potato-tubers infected by Phytophthora infestans.**—*Ann. of Appl. Biol.*, xiii, 2, pp. 289–300, 1 pl., 1926.

After a brief critical review of the work of de Bary, Jensen, Pethybridge, and Melhus in connexion with the hibernation of potato blight (*Phytophthora infestans*), the writers record the occurrence (said to be reported for the first time in England) of diseased shoots arising from infected seed-tubers.

Of 25 naturally infected Field Marshal tubers planted early in April, 1925, in pots in the greenhouse, two produced by 16th May short, diseased shoots which developed conidiophores and spores. These shoots are believed to have been infected *ab initio* by mycelium growing from the tuber. They could not have been infected by oospores in the soil, firstly, because these bodies are not definitely known to occur in nature; secondly, because the soil used in the tests had not previously grown potatoes; and thirdly, because the remaining 21 plants continued perfectly healthy under identical conditions.

A probable case of secondary infection was observed on a leaf of one of the healthy shoots of a plant which produced a diseased shoot.

De Bary's theory of the perpetuation of the disease by means of the mycelium within the tuber is considered to be established beyond doubt by these investigations.

MÜLLER (K. O.). **Ueber die wirtschaftliche Bedeutung, die Symptome, und die Bekämpfung der Kraut- und Knollenfäule der Kartoffel.** [On the economic importance, symptoms, and control of late blight of Potatoes.]—*Mitt. Deutsch. Landw.-Gesellsch.*, xli, 27, pp. 567–571, 1926.

An account is given of the origin, life-history, and symptoms of late blight of potatoes (*Phytophthora infestans*), which in Germany is stated to be most prevalent in maritime districts with a cool, damp summer climate.

Laboratory experiments showed that the zoospores of the fungus can infect the lenticels and eyes of freshly collected tubers [see also this *Review*, i, p. 254]. At 25° C. no symptoms appeared within three days of inoculation, and at 20° the disease took a week to develop. At 18° to 23° the estimated growth of the hyphae in the

tissues is 3 to 4 mm. per diem. At 10° to 25° the most frequent secondary organisms invading infected tubers are bacteria and *Fusarium* spp., and 72 per cent. of two lots of stored potatoes examined for the presence of storage pathogens showed hyphae of *P. infestans*.

Recent investigations have shown that resistance to late blight as well as productivity are hereditary characters, and plans are under consideration for the development of resistant varieties with the aid of some wild South American strains which showed complete immunity during an epidemic in 1922. The production of such varieties is regarded as highly desirable in view of the estimated annual loss from late blight in Germany, namely, one-twentieth of the average harvest of 30,000,000 tons.

Potato blights.—*New Jersey Agric. Exper. Stat. Circ.* 192, 2 pp., 1926.

Under New Jersey conditions late blight of potatoes [*Phytophthora infestans*] is stated to appear only in wet weather, and when the temperature falls to about 50° F. on several consecutive nights [see also this *Review*, iii, p. 173; v, p. 627]. Brief popular notes are given on this disease as well as early blight [*Alternaria solani*], tipburn, and hopperburn. Control measures should consist of thorough and frequent applications of 5-5-50 Bordeaux mixture plus 1 to 3 lb. lead arsenate per 100 galls., using 50 to 75 galls. of spray per acre for small plants and at least 100 galls. for large ones.

Appel [O.]. **Gelbfleckigkeit der Kartoffelstauden.** [Mottling of Potato plants.]—*Deutsche Landw. Presse*, liii, 17, p. 209, 1 col. pl., 1926.

A brief, popular account is given of the non-infectious mottling of potato foliage which is stated to be frequently observed in seedlings as a result of unsuitable environmental conditions, e. g., cold spring weather. Arrested development and a reduction of yield often accompany this condition, which has been found to be due to metabolic disturbances and to be quite distinct from the variegation associated with mosaic.

McLarty (H. R.). **Witches' broom of Potatoes.**—*Scient. Agric.*, vi, 11, p. 395, 3 figs., 1926.

Some damage is stated to have been caused in commercial potato plantings in British Columbia by the disease known as witches' broom, the symptoms of which are very briefly indicated [see this *Review*, iv, p. 55]. Infection is believed to spread slowly from plant to plant in the field. Careful roguing and tuber selection should suffice to hold the disease in check.

Harter (L. L.) & Whitney (W. A.). **Influence of soil temperature and soil moisture on the infection of Sweet Potatoes by the black rot fungus.**—*Journ. Agric. Res.*, xxxii, 12, pp. 1153–1160, 2 figs., 1926.

Experiments with sweet potatoes (*Ipomoea batatas*) of the Yellow Jersey variety to test the relation of soil temperature and moisture

to their infection by the black rot fungus (*Ceratostomella fimbriata*) proved that 100 per cent. infection occurred at temperatures between 15° and 30° C. The optimum for the disease was about 25°, whilst slight infection occurred at 10° and none at 35°.

Soil moisture also considerably influenced the extent to which the disease developed on the infected plants. This increased with the increase in water-holding capacity of the soil up to approximately 60 per cent., and then decreased. It is thought, however, that infection will occur at any moisture content at which the plant can grow, since all plants grown in soils with from 14 to 100 per cent. water-holding capacity showed some degree of infection.

Wounding was shown to be unnecessary for infection, which took place in 48·2 per cent. of uninjured potato sprouts dipped in a spore suspension of the organism.

Observations on the growth of the control plants showed that the optimum temperature was about 35°; at 10° they slowly died and at 15° they did not make fresh growth.

WEIR (J. R.). **A pathological survey of the Para Rubber tree (Hevea brasiliensis) in the Amazon Valley.**—*U.S. Dept. of Agric. Bull.* 1380, 129 pp., 21 pl., 1926.

During the period from 3rd August to 26th November, 1923, the writer studied the diseases of *Hevea brasiliensis* and related species in the Amazon Valley in connexion with an investigation of the sources of crude rubber.

Many of the fungi found are stated to be very imperfectly known. The range of hosts of the wood-destroying species often differs widely from that of the same species in the eastern tropics. A few are apparently exclusively American in distribution, while others of pathogenic importance are new to science. The entire field of the Amazon Valley is stated to be practically unexplored from a mycological point of view and therefore of great interest.

Leaf blight (*Dothidella ulei*) [syn. *Melanopsammopsis ulei*] is without doubt the most serious disease of rubber foliage in the American tropics [see this *Review*, v, p. 324]. At almost every station in the lower Amazon Valley this fungus was found causing more or less severe damage to planted rubber, young trees sometimes being very severely affected, while in the upper stretches the disease was less prevalent. All species of *Hevea* appear to be susceptible but no other host is known.

The life-history of the fungus includes three distinct spore forms, conidia, pycnidia, and ascospores. The first symptoms occur on young leaves in the form of translucent olive- or blackish-green, velvety, scattered spots which may coalesce until the whole surface is involved. The velvety appearance is due to the development of immense numbers of short, erect conidiophores, with swollen bases, on which 1- or 2-celled conidia are borne. The edges then begin to roll and the entire leaf crumples up, turns black, and hangs limply from the twig as though scorched. Sometimes only the edges, apex, or basal glands of the leaf are affected, in which case the unequal stress caused by the development of the uninfected parts tears the

diseased portion, which may fall away or leave irregular holes extending towards the midrib. Such leaves present a very ragged appearance and finally drop, usually leaving the petioles attached. In cases of sparing infection the spots do not coalesce but the diseased tissue changes colour and falls out, giving a shot hole effect.

Small, spherical, black bodies, representing the pycnidial stage, appear round the edges of the original areas of infection on young leaves which have escaped entire destruction by their rapid growth. These fructifications develop singly or in masses on a pseudoparenchymatous stroma from a brown, septate mycelium.

One or two months later the large, black, spherical perithecia appear round the margin of the old spots, or grouped in the centre of small, brownish, hypertrophied areas scattered over the leaf surface.

All three spore forms occur on the leaves, petioles, young stems, inflorescences, and fruits. On the petioles and stems infection is first apparent as slightly elevated greenish or yellowish areas, which soon turn black. The surface tissues are ruptured, the bast is hypertrophied, and small but definite cankers are formed. Cankered stems bearing perithecia and terminating in well-grown leaf clusters were frequently observed.

It is believed that a thorough survey of the available territory will result in the discovery of regions where rubber may be grown with little risk of serious damage from leaf blight. In the wild state the degree of infection is relatively slight, the natural jungle growth serving as a barrier against the wide distribution of spores.

A large number of other leaf diseases were observed, including a leaf spot caused by *Phytophthora faberi*. *Gloeosporium alborubrum* seriously damaged young leaves and caused a shot hole disease of older ones. *Phyllosticta heveae* caused a uniform brown blighting of the distal parts of the leaves.

Amongst parasitic Polyporaceae observed were *Polyporus* [*Fomes*] *lignosus*, *Ganoderma amazonense* n. sp. (causing considerable damage from root rot), *G. australe* (once found as a wound parasite), *Trametes corrugata* (also a wound fungus), and *T. floccosa* (apparently causing root decay in one instance).

Ustulina zonata was associated with cankers and decay of woody tissues, *Megalonectria pseudotricha* occurred as a wound parasite of stems, *Rosellinia bunodes* and *R. puiggarii* were found on *Hevea* roots, while *R. pepo*, *R. australis*, and *R. subiculata* occurred on other hosts.

Of the branch diseases *Corticium salmonicolor* was observed but was apparently harmless; *Diplodia* [*Botryodiplodia*] *theobromae* was common and sometimes seemed injurious; white thread blight (*Marasmius* spp.) was occasionally seen; and the black-bark fungus (*Nummularia anthracodes*) occurred in living bark and is thought to be possibly the same as the fungus named *Eutypella caulivora* in the East. Brown bast was uncommon and very mild.

Notes are given on various other diseases attributed to fungi or to physiological disturbances, but the drastic system of tapping in vogue in the Amazon Valley [which is briefly described] is alleged

to be responsible for more damage to the trees than all other causes combined.

A complete list of the fungi recorded on *Hevea* from all parts of the world and a bibliography of 600 titles are appended.

STOUGHTON-HARRIS (R. H.). **A preliminary report on a method of treatment for Ustulina collar-rot.**—*Fourth Quart. Circ. for 1925, Rubber Res. Scheme (Ceylon)*, pp. 10–13, 4 pl., 6 diags., 1926.

After briefly summarizing the most frequent causes of failure in the treatment of collar rot of rubber trees (*Ustulina zonata*) [see this *Review*, v, p. 580], the writer describes his method for the control of this disease.

The first and most important part of the work is the complete excision, with a chisel and mallet, of all diseased tissue. The cavity should be shaped by undercutting the sides all round, so as to leave a ledge at least half an inch thick which will keep the filling in place. All exposed wood should then be very carefully tarred or treated with a strong preservative, such as brunolinum or solignum, which must on no account, however, be allowed to touch the cut edges of the bark. The whole of the inside of the cavity may now be lined with a facing of a 1 : 2 cement-river sand mixture, care being taken that the latter ingredient is absolutely clean. The filling is built up with clean split stone, the larger main blocks being approximately square, and a 1 : 3 cement-sand mixture used as mortar. After filling the entire cavity, the surface should be faced with a 1 : 2 cement-sand mixture and finally with pure cement. The filling should then set to a solid mass without any cracking or shrinking, the callus growing over the surface and forming a hermetic seal round the edges. Trees properly treated by this method can be completely saved.

The average total cost per tree treated on the Culloden Estate, Neboda, Ceylon, was about Rs. 4 per tree. This figure is increased to Rs. 6 by the employment of a mason (which is very desirable) for the actual work of filling. The method should be profitable, therefore, if the trees can be saved for any period exceeding two years.

ASHPLANT (H.). **Circulars of the Rubber Specialist. No. 3. Secondary leaf fall disease of Rubber.**—*Planters' Chron.*, xxi, 26, pp. 422–430; 28, pp. 451–461, 1926.

The great success of spraying in the control of secondary leaf fall of *Hevea* rubber (*Phytophthora meadii*) in South India [see this *Review*, v, p. 53] is stated to have reduced interest in other measures directed towards the same object. In this paper a full description is given of the very extensive manurial experiments carried out in 1922 and 1923, using varying quantities of potassium sulphate, potassium muriate, sodium, potassium, calcium, and ammonium nitrates, ammonium sulphate, and a number of other substances [which are enumerated]. The results of the experiments [presented in tabular form] were on the whole very disappointing, the only improvement being recorded in the plots fertilized with sodium nitrate, ammonium sulphate, or ammonium nitrate. The trees in

these plots showed some degree of resistance, but in no case were the results of such a nature as to justify the expenditure. Heavy losses (complete defoliation in some cases; while rarely less than half the trees in any plot, and in many cases 60 to 80 per cent., were defoliated to the extent of 50 to 75 per cent.) were incurred in the great majority of the treated plots. No benefit was derived from the direct administration of nutrient solutions to the roots.

Ceylon Rubber Research Scheme.—*Bull. Rubber Growers' Assoc.*, viii, 6, pp. 279–286, 1926.

In this report of the Fourth Ordinary General Meeting of the Rubber Research Scheme (Ceylon), the following references of phytopathological interest are given, apart from those already noticed in this *Review*.

The results of experiments on the Gallawatte estate, reported by Mr. J. Mitchell, indicate that a marked improvement in foliage of trees suffering from secondary leaf fall (*Phytophthora*) [? *meadii*] can be secured by manuring [but see preceding abstract].

Brown bast has shown a reduction, or at least no increase in severity, during the year, probably on account of more conservative tapping which resulted from the restriction of production,

The control of secondary leaf fall by spraying, a practice in vogue in southern India, was discussed by Mr. Stoughton-Harris with reference to conditions in Ceylon. The intensity of attack is far less severe in Ceylon than in south India in correlation with the milder monsoon conditions, and an extensive campaign of spraying is considered at present to be unnecessary. The cost of spraying in India is Rs. 11 to Rs. 12 [about 16*s*. 6*d*. to 18*s*.] per acre, and in Ceylon should not exceed Rs. 15. For spraying purposes in India the operators climbed every other tree and sprayed half the next tree on either side as well as the tree climbed, the spray being directed upwards. At least half an inch increase in girth each year occurred on sprayed trees as compared with unsprayed; the former also held their leaves much longer, and gave 10 lb. per acre greater yield each year [see also this *Review*, v, p. 53].

THIERENS (J. W.). **Iets over de bestrijding van 'mouldy-rot'.** [A note on the control of mouldy rot.]—*Indische Culturen* (*Teysmannia*), xi, 11, pp. 294–295, 1926.

The writer has obtained excellent results in the control of mouldy rot of rubber [*Ceratostomella fimbriata*] by alternating monthly periods of tapping and rest. In the area due for tapping all diseased trees are painted over the whole of the previous month's tapping surface with a tepid mixture of equal parts of coal-tar and diesel oil, to which a cupful of slaked lime may be added for the neutralization of the acids in the former component. The trees undergoing rest are similarly treated over 2·5 cm. of the tapping-cut. Provision is made for regular inspection of the trees in both the tapping and resting areas. On the writer's estate this method reduced the number of cases from 800 to 15 per diem during the wet season, and to 22 a month after the cessation of the rains.

Ashplant (H.). **Circulars of the Rubber Specialist. No. 2. Deep tapping versus shallow tapping.**—*Planters' Chron.*, xxi, 22, pp. 353–357, 1926.

In order to obtain exact evidence on the influence of various tapping systems on the development of brown bast of rubber, experiments have been carried out at the Mooply Experimental Station, south India, from 1921 onwards on two groups of fifty trees each. One group was tapped daily to within $\frac{3}{4}$ to 1 mm. from the cambium on the back quarter and to within 2 to 3 mm. from the cambium on the front quarter; the other group was similarly tapped but only on alternate days. The experimental data taken as from May, 1923, were as follows. The average annual yields per 100 trees were 616 lbs. for the deep cut and 134 lbs. for the shallow cut daily tapping, and 386 lbs. and 80 lbs., respectively, for alternate day tapping, the corresponding percentages of trees developing brown bast per annum being 12, 6·3, 6·3, and 4·2, respectively. Deep tapping, therefore, is considerably more provocative of brown bast than shallow tapping of the same frequency, whilst the generally favoured system of deep alternate day tapping is no more conducive to brown bast than a shallow system of daily frequency and the yield is much higher.

The author regards brown bast as an inseparable concomitant of tapping in any form. Deep tapping obviously affords greater possibilities of infection than shallow tapping, but only absolute immunity from the disease would justify the consideration of the adoption of the latter uneconomic method.

Tapping frequency appears to be the most important factor in the causation of brown bast. There is no proportionate relation between the incidence of brown bast and the amount of latex removed [see also this *Review*, iv, p. 187], and other factors must therefore play a part.

The results of experiments on the incidence of stripe canker [*Phytophthora meadii*] on deep and shallow tapped cuts showed that the percentages of cuts infected during the monsoon period, up to the end of September, with deep cuts and shallow cuts is 100 and 44, respectively, for daily tapping, and 96 and 40, respectively, for alternate day tapping. The increase in infection in deep cuts is doubtless caused by exposure of more delicate tissues.

[This paper is reprinted in *Trop. Agriculturist*, lxvii, 1, pp. 36–40, 1926.]

Taylor (R. A.). **A brown bast census.**—*Third Quart. Circ. for 1925, Rubber Res. Scheme (Ceylon)*, pp. 7–10, 1925. [Received July, 1926.]

The results of three inspections (September, 1923, October–November, 1924, and October, 1925) for brown bast disease of a ten-acre rubber plantation of 1,000 trees in the Kalutara district of Ceylon [see this *Review*, v, p. 581] are discussed in greater detail than in previous reports.

The following symptoms were taken as conclusive evidence of disease: presence of the characteristic brown markings; absence of latex from all but the innermost layers; and sodden condition

of the bark. The continuous exudation of beads of thickish or rapidly coagulating latex from the cut some time after tapping may also be considered fairly conclusive proof of the presence of brown bast in an early stage.

In 1923, 135 trees were diseased (13·5 per cent.). In 1924 there was an increase of 6·2 per cent., and in 1925 a further rise of 4·8 per cent., making a total of 24·5 per cent. affected individuals.

A portion of the field, involving 159 trees, is subject to flooding, and of these trees only 15 (9·4 per cent.) were found to be attacked. Early in 1924, 88 of the badly affected trees were scraped and tarred, and of these 70 are stated to have shown satisfactory renewal, while the remainder will be out of action for several years as the result of the treatment.

The practice of opening a fresh cut higher up the tree to replace one which has dried up is deprecated, observations having shown that such new cuts rapidly develop brown bast. It was noticed that certain areas of bark which had not been tapped sometimes showed symptoms of the disease while the rest of the tree was healthy. This absence of the spread of infection appears to support the isolation method of treatment [ibid., iv, p. 766]. It was found in 1925 that many of these 'islands' had latex in the inner layers, showing that the new layers of tissue laid down by the cambium had not become affected.

O'Brien (T. E. H.). **Notes on paranitrophenol.**—*First Quart. Circ. for 1926, Rubber Res. Scheme* (*Ceylon*), pp. 9–10, 1926.

A number of tests with paranitrophenol for the prevention of spotting of crepe rubber [see this *Review*, v, p. 126], have now been carried out in Ceylon with satisfactory results. The following method has been found reliable. A 0·1 per cent. solution is made by dissolving 6½ oz. of paranitrophenol in 40 galls. of water. Fifty to sixty sheets are then placed one by one in the solution, this process being repeated five times. Forty gallons of solution should suffice to treat about 400 lb. of rubber. To accelerate the solution of the paranitrophenol, it may be dissolved in two galls. of boiling water, the black sediment being strained off through muslin as the strong solution is poured into the remaining 38 galls. of water. In order to prevent the discoloration of the solution by lime salts, 3 to 4 oz. acetic acid may be added to the paranitrophenol. The latter is stated to be available in Colombo at present at a price of Rs. 1·75 [= about 2*s*. 6*d*.] per lb.

Riols (P.). **Note sur le mildew du Houblon.** [Note on the mildew of the Hop.]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 26–30, 1926.

The author states that the downy mildew of the hop (*Pseudoperonospora humuli*), which first appeared in the valley of the Tille (Côte d'Or) in the spring of 1925 [see this *Review*, v, p. 186], caused severe damage in that area during the past year. From the fact that the districts infected are some distance apart it is thought that the disease has probably existed in the south of France for some years past. The symptoms [which are described] correspond closely to those previously reported by Salmon and Ware [ibid.,

v, p. 638]. During the warm dry weather in June, 1925, the fungus made little progress, but the damp heat of July and early August favoured the production of summer spores and the young leaves and the bracts and bracteoles of the cones became infected, the loss resulting from the injured cones being very serious.

With reference to the occurrence of the fungus on nettles [ibid., iv, p. 703; v, p. 639] it was observed that although both wild and cultivated hops were attacked, Urticaceae growing in the neighbourhood were apparently unaffected.

Treatment with fungicides is not recommended when the cones are attacked, owing to the approaching harvest, and the most promising method of control lies in the selection of resistant varieties. According to the author's observations, the variety Rambervillers, which is highly valued in the market, appears to be extremely resistant, and although this variety is susceptible to *Oidium* (*Sphaerotheca humuli*) this is no reason for its rejection, as the latter disease can be easily prevented by the timely application of sulphur. The high lupulin content of this variety further counterbalances this disadvantage, and the importance of its extended planting is emphasized. It is also stated that the variety Haguenau appears to be very susceptible and the Alsatian hop moderately resistant.

SHEPHERD (E. F. S.). **Diseases of Sugar Cane in Mauritius.**—*Mauritius Dept. of Agric. Bull.* 32, Gen. Ser., 18 pp., 11 figs., 1926.

Notes are given on the symptoms and control of the following diseases of sugar-cane in Mauritius. Red rot (*Colletotrichum falcatum*) [see this *Review*, iv, p. 124]; smut (*Ustilago sacchari*) [*U. scitaminea*]; top rot and gumming disease [ibid., iv, p. 125]; root disease [ibid., iv, p. 569]; pineapple disease (*Thielaviopsis paradoxa*); leaf spots (*Leptosphaeria sacchari* and *Helminthosporium* sp.); mosaic, which is believed to have been entirely eradicated from Mauritius, while the supposed trace on the Island of Réunion is now thought to have been streak disease; and streak disease [ibid., v, p. 56], which has since been detected on maize at widely separated localities (Olivia S.E., Old Grand Port, and Réduit), on *Coix edulis* at Pamplemousses, and on seven species of wild grasses at Astroea S.E., Old Grand Port, and Antoinette S.E. Attempts to transmit streak disease from infected to healthy maize plants by an undetermined species of leafhopper, and from infected to healthy sugar-canes by *Aphis sacchari* have hitherto given negative results.

McRAE (W.). **Mosaic disease of Sugar Cane in India in 1925.**—*Agric. Journ. of India*, xxi, 3, pp. 198–202, 1926.

Mosaic disease of sugar-cane, first described in 1892 from Java, was not found in India until 1921 when Dastur discovered it on two varieties at Pusa [see this *Review*, iii, p. 364]. In 1924, suspected specimens sent by Mr. Noel Deerr to Java were reported to be infected with mosaic, and in 1925 Subramaniam found typical infection in the variety Co. 213 at Pusa. The search was immediately extended to other parts of India, with the result that the disease has been found at various places in Bihar, United Provinces,

Punjab, Madras [ibid., v, p. 251], and Bombay, while in a foot-note it is stated that Burma and Assam are also infected.

Though the Coimbatore Sugar-Cane Breeding Station is now reported to be free from mosaic, there is evidence that the disease has existed there, as consignments of seedlings sent to Mauritius in 1923, and to Cuba in 1924, were both found to be infected. During 1925 mosaic appeared in epidemic form throughout a large tract of northern India on Hemja, a commonly grown indigenous cane, doing considerable damage. Many Coimbatore canes are also susceptible, whilst of the thick canes examined, Red Mauritius, Purple Mauritius, Mauritius 16, B 6308, and A 2 were always fully infected.

A consideration of all the evidence available has led the author to conclude that mosaic disease has existed for a long time among the thin canes of northern India, where in fact it is probably endemic.

COTTRELL-DORMER (W.). **Bureau of Sugar Experiment Stations. Notes and observations on the red streak associated with Queensland top rot disease.**—*Queensland Agric. Journ.*, xxv, 5, pp. 406–414, 6 figs., 1926.

In this paper the author gives the result of his investigation of the relationship between the red streaks occurring on sugar-cane, especially on the variety Badila (N. G. 15), in Queensland and top rot disease, of which they have been suspected of being an early stage [see this *Review*, ii, p. 582]. The first symptom is the presence of a narrow, dark watery-green, longitudinal streak, about 1 to $1\frac{1}{2}$ inch in length, at the base of the young leaf blade. This streak grows rapidly, and the colour changes to a watery brown and then to bright blood red. Fresh streaks are meanwhile formed, and under favourable conditions the disease progresses until all the younger leaves are covered with brilliant red lines, which may coalesce, forming broad bands. Infection may, however, cease to be active after the formation of a single streak. The most vigorous streaks are invariably marked with brown or white stains, which are attributed to the drying of some exudation formed during growth.

A form of top rot appears to be closely associated with these red streak symptoms, and fully 90 per cent. of the stalks whose hearts had been killed by top rot showed one or more leaves marked by red streaks.

Very similar, if not altogether identical, symptoms, attributed to bacteria and closely connected with top rot, have already been recorded in Hawaii [ibid., v, p. 131] and apparently in Tucumán [ibid., ii, p. 338]. In the present investigations bacteria were also found in red streak tissue, and inoculations with bacteria from diseased leaves, grown on potato but not isolated in pure culture, resulted in the production of the symptoms of red streak and of top rot. The former symptoms were also produced with bacteria taken directly from an active red streak infection.

KELLY (N. L.). **Bureau of Sugar Experiment Stations. Assistant Plant Pathologist's Report.**—*Australian Sugar Journ.*, xviii, 3, pp. 171–172, 1926.

The symptoms, cause, mode of dissemination, and control of

mosaic disease of sugar-cane are briefly described, and attention is drawn to its presence in various parts of Queensland, especially on the Shahjahanpur 10, Gingila, and M. 1900 Seedling varieties. The weight of mosaic stools may be only half the normal, and the average loss from the disease is estimated at 40 per cent. Gumming disease [*Bacterium vascularum*] and iliau [*Melanconium iliau*: see this *Review*, iv, p. 568] were found in various parts of the Isis district on D. 1135 and M. 1900 Seedling, respectively. The symptoms of both diseases are briefly described. 'Knife cut' [ibid., iii, p. 686] was found in one-year-old D. 1135 and to a much slighter extent in M. 1900 Seedling; observations by G. P. Schmidt, extending over ten years, indicate that during dry weather a joint near the top of the cane contracts; on the return of normal conditions a bulge appears on one side of this joint, followed shortly by a transverse break or cut on the other.

DODDS (H. H.). **Cane varieties suitable for Natal.**—*African Sugar and Cotton Planter*, ii, 5, pp. 11–14, 1926.

In July, 1925, specimens of Kassoer, Toledo, Oshima, Kinar, and Kavangire sugar-cane were received at the Natal Sugar Experiment Station from the United States Department of Agriculture. After thorough fumigation and protracted quarantine observation these canes were released in April, 1926, and cuttings of each planted out. All have made a promising beginning.

Kassoer is a hybrid between Black Cheribon and a wild cane (*Saccharum spontaneum*), the former being highly susceptible to mosaic and the latter conferring immunity on its progeny. This variety is a heavy yielder (giving 70 tons per acre after seven months' growth in Argentina), but its sucrose content is very low. A diagram is given representing the origin and relative resistance to mosaic of the descendants of Kassoer cane.

Oshima, Meethi, Kinar, and Kavangire are all of the group classified by Barber as North Indian and by Brandes as Chinese. They are resistant to root disease but subject to smut [*Ustilago scitaminea*] and red rot [*Colletotrichum falcatum*].

The mosaic-immune Toledo variety [see this *Review*, ii, p. 468], which much resembles D. 1135, showing a good sucrose content and purity, is believed to be possibly a hybrid of *S. spontaneum*.

Further notes are given on a number of varieties which are either already being tested in Natal or have been requested from Washington for this purpose. Among other points of interest may be mentioned the probable immunity from mosaic of the Indian varieties Co. 205 (a hybrid of Vellai with *S. spontaneum*) and Co. 214 (a descendant of Striped Mauritius, crossed with the offspring of Saretha and *S. spontaneum*). The Barbados seedling, S.C. 12/4, is stated to be somewhat susceptible to mosaic, while the Philippine variety Hind's Special is alleged to be immune from mosaic and smut.

CAUDWELL (E. S.). **Cane experiments at Umbogintwini.**—*African Sugar and Cotton Planter*, ii, 6, pp. 7–9, 1926.

In this paper, read before the [Fourth] Sugar Congress at Durban [April, 1926], the writer gives a progress report of the experimental work which is being carried out at Umbogintwini (Natal) in con-

nexion with streak disease of sugar-cane [see this *Review*, v, p. 189].

Four healthy and four streaked plots planted in March, 1924, showed, after eight months, complete infection of all plots. The difference in yield of the cane, cut in October, 1925, was found to be 11 per cent. in favour of the originally healthy cane. These plots have been continued without further treatment to ascertain whether the difference will be maintained in the ratoons.

Three further series of plots were planted in October, 1924, one of which is receiving irrigation. So far this process has not reduced the spread of the disease.

In another experiment, healthy canes planted in October and November were found to make much more rapid growth than those planted in any previous month.

Investigations are also in progress on the effect of phosphatic fertilizers, of soil improvement, and of crop rotation on the control of the disease.

TOGASHI (K.). **Notes on some parasitic fungi of Japan.**—*Bull. Imper. Coll. Agric. and Forestry* (Morioka, Japan), ix, pp. 17–29, 3 figs., 1926.

In September, 1924, a fungus corresponding in essential characters with *Bremia graminicola* Naoumoff (*Bull. Soc. Myc. France*, xxix, p. 275, 1913) was observed on *Arthraxon ciliaris* at Kyoto. The conidiophores are hypophyllous, rarely epiphyllous, caespitose, flocculose, at first whitish, later greyish, generally 460 to 760 μ long (often up to 825 μ), 7·5 to 10 μ broad, with somewhat swollen bases, and five to six times dichotomously branched, the branches being more or less recurved and with swollen ends, bearing four to five papillae. The conidia are papillate and measure 11 to 15 μ in diameter. The fungus produces large yellowish, later brownish spots, at first delimited by the veins but finally occupying the whole surface of the leaf and causing desiccation.

In June, 1924, a new species of *Physalospora*, *P. japonica*, was found on *Thea japonica*. The amphigenous, subepidermal, papillate, erumpent, membranous, olivaceous-black, globose or globose-ovoid perithecia occurring singly or in groups on the pale brown, undefined spots, are 108 to 164 μ in breadth and 128 to 200 μ in height. The asci are clavate, often cylindrical, attenuated at the ends, shortly stipitate, hyaline, 60 to 84 by 7 to 13 μ, and contain eight biseriate (sometimes obliquely uniseriate), fusiform or subfusiform, continuous, granular, hyaline ascospores, measuring 15 to 22 by 5 to 7·4 μ. Numerous filiform paraphyses, longer than the asci, are present. The fungus is readily distinguishable from *P. neglecta* Petch, the only known species of *Physalospora* parasitic on *Thea* and *Camellia*, by its much larger asci and ascospores.

In June, 1924, *Phyllosticta citrullina* was observed producing large, suborbicular or irregular, dark brown, often confluent spots with concentric rings on watermelon leaves. The brown, membranous pycnidia are amphigenous, punctiform, immersed, scarcely erumpent, lenticular, and measure 87 to 140 by 52 to 87 μ. The conidia are hyaline, cylindrical, rounded at both ends, generally continuous but sometimes uniseptate, straight or slightly curved,

and 7·5 to 11·25 by 2·5 to 4 μ. The *Phyllosticta* described by Yoshida (*Journ. Plant Protection*, vi, p. 16, 1919) as the cause of a black spot of watermelons has ellipsoidal conidia, measuring 2·5 to 8 by 2 to 4·5 μ.

Septoria callistephi Gloyer (*Phytopath.*, xi, p. 50, 1921) was found in June, 1924, producing irregular, tawny coloured spots on the China aster (*Callistephus chinensis*). The epiphyllous, scattered, innate, roundish or lenticular, membranous pycnidia measure 88 to 120 μ in breadth and 78 to 112 μ in height, and the conidia are filiform, elongate-cylindrical, often tapering, hyaline, non- to triseptate, and 23·4 to 43·2 by 1·2 to 1·8 μ.

AGOSTINI (ANGELA). **Contribuzione alla flora micologica del Senese.** [Contribution to the mycological flora of the province of Siena.]—*Arch. Bot. Sistematica,* i, 4, pp. 221–245, 5 figs., 1925. [Received July, 1926.]

In this paper the writer briefly describes one hundred species of fungi not previously reported from the province of Siena. Of the new Italian records the following are of special interest. *Ascochyta betae* and *Septoria betae* on beet leaves; *A. fabae* (said to be new to Europe) on bean (*Vicia faba*) leaves; *Gloeosporium aurantiorum* on leaves of *Citrus aurantium* var. *bergamia*; and *Leptothyrium pomi* on apples.

FOËX (E.). **Notes sur quelques Érysiphacées.** [Notes on some Erysiphaceae.]—*Bull. Soc. Myc. de France,* xli, 4, pp. 417–438, 15 pl., 1 fig., 1926.

Continuing his study of the Erysiphaceae [see this *Review*, iv, pp. 152, 316], the author deals with the morphology and cytology of *Sphaerotheca pannosa* on the rose, *Podosphaera oxyacanthae* var. *tridactyla* on the apricot, *P. leucotricha* on apple and pear, *Phyllactinia corylea* on *Paliurus australis*, and *Microsphaera mougeotii* on *Lycium barbarum*.

In *S. pannosa* the conidiophore originates as a swelling on a vegetative hypha immediately above the nucleus; the swelling rapidly elongates into a tube which is separated from the hypha by a septum after the original nucleus or one of the daughter nuclei formed by its division has passed into it. After nuclear division the tube is divided into two cells, of which the basal becomes the pedicel of the conidiophore, while the upper divides in like manner until the conidiophore consists of six or eight cells, of which the two or four topmost are barrel-shaped. In this species the conidiophore is never entirely disarticulated, so that the basal cell always bears a chain of several cells above it. The conidiophore contains fibrosin bodies which only attain their final shape (oval or oblong) and dimensions (1·8 to 3·6 by 1 μ) in the conidium.

The conidiophore of *P. oxyacanthae* var. *tridactyla* originates as a swelling on a hypha; after receiving a nucleus from the latter it rapidly elongates into a tube closed at its base by a septum. The nucleus within the tube then divides and a short apical cell is cut off which again divides, forming a new cell at the apex, the process being repeated until the conidiophore is composed of usually eight, somewhat moniliform, cells. As in the preceding species the conidio-

phore does not break up entirely. Its topmost cells contain well-developed fibrosin bodies, for the most part in the shape of a hollow cone, corresponding in size to the dimensions indicated by Zopf. In the lower cells these bodies are rare and small, or may even be absent.

In *P. leucotricha* the conidiophore is formed in the same way as in the foregoing species, but it is thicker and rapidly breaks up into rounded, almost spherical conidia. Zopf's fibrosin bodies are present in the conidiophores of this species also.

In *Phyllactinia corylea* the first indication of the conidiophore is the formation of a slender cylindrical cell which rapidly elongates perpendicularly to the hypha on which it arises. Following nuclear division this cell is separated into two, of which the basal cell is much longer and thinner than the apical; the protoplasm in the latter is much denser than in the former. New elements are formed by continued division of the apical cell. Finally, the conidiophore is composed of a thread-like basal cell, in which the protoplasm is concentrated at the top, and of two to four cells progressively increasing in diameter towards the top of the conidiophore; the terminal cell, which is the only true conidium, is of a characteristic ovoid-conical shape.

WOLLENWEBER (H. W.). **Pyrenomyceten-Studien. II.** [Studies on Pyrenomycetes. II.]—*Angew. Bot.*, viii, 3, pp. 168–212, 4 pl., 1926.

The author has undertaken a revision of certain genera of Hypocreaceae and provides an analytical key for the determination of species of *Nectria*, *Hypomyces*, *Calonectria*, *Gibberella*, and *Pleonectria*. New or revised diagnoses of a number of these forms are given.

WHETZEL (H. H.) & KERN (F. D.). **The smuts of Porto Rico and the Virgin Islands.**—*Mycologia*, xviii, 3, pp. 114–124, 1 pl., 1926.

This annotated list of the smuts recorded in Porto Rico and the Virgin Islands was compiled by the authors from a survey of the material available in various herbaria of the United States and of the literature in which reference to them is made. It comprises 23 species.

THOM (C.) & CHURCH (MARGARET B.). **The Aspergilli.**—ix + 272 pp., 2 pl., 14 figs., Baltimore, The Williams & W kins Co., 1926.

This important monograph of the genus *Aspergillus* is at once biological and taxonomic, and is by far the most complete survey of these fungi that has appeared. For taxonomic purposes some 13 main groups or 'collective species' are recognized. The attempts which have been made to divide the genus by separating *Sterigmatocystis*, *Euaspergillus*, *Aspergillopsis*, and *Diplostephanus* as distinct genera are considered to fail in essential particulars and the authors prefer to maintain the generic name *Aspergillus* in

preference to *Eurotium* for the whole group of related forms. For each collective species there is a characteristic range of colony colour: within some of these groups the shade of colour in the different species may vary with age and environment, but in others it is more fixed.

The morphological characters of importance in classification are discussed in detail. The colour, shape, size and arrangement of the conidial heads and conidia and certain characters of the foot-cell and conidiophore are characteristic of the species, 64 of which and two varieties are accepted by the authors to include both forms known to them in culture and forms which they consider to be probably valid species described by other authors. Many forms will maintain their morphological characters in culture under favourable conditions for long periods, but others may form mutants, and in the *A. flavus-oryzae* group especially there is considerable variation. The main groups have certain essential morphological characters in common and usually present fundamentally related biochemical characters, but the distinction of the species within some of these groups is difficult on account of the range of intermediate forms that are met with. Two short group keys are given for the rapid reference of a given species to its group, one based on the colours of heads and stalks and the other on real relationship as determined from a more complete study of the characters. In the detailed synoptical key to the recognized species at the end of the book the latter is the basis.

There are separate chapters on the culture of these fungi, their physiological and biochemical characters, their enzymic activity and utilization in industry, and their relationship to disease in animals and man.

BERKELEY (G. H.). **Studies on Botrytis.**—*Trans. Roy. Canadian Inst.*, xv, 1, pp. 83–127, 5 pl., 17 graphs, 1924. [Received August, 1926.]

The genus *Botrytis* is stated to be in a state of extreme confusion from the systematic standpoint, even the identity of many of the forms on which important critical studies have been based being doubtful. Much of this confusion is thought to have resulted from inadequate knowledge and misinterpretation of supposed connexions between the conidial and perfect stages of species of *Botrytis*. It has been too frequent a practice to describe the latter largely on the basis of host relationships, with little or no regard to their morphological or physiological characters. It is now certain, however, that some of the more apparent morphological characters are not sufficiently sharply defined to have a clear taxonomic significance. Before such characters can be employed as taxonomic criteria, their complete constancy while passing through a variety of standard conditions must be demonstrated.

In these studies four morphologically distinct strains belonging to the *B. cinerea* group, I, IV, VII, and IX, isolated, respectively, from geranium, squash [*Cucurbita pepo*], sunflowers, and hemp, were used in the experiments [the technique of which is fully described].

The first part of this paper is confined to a comparative study of

the nitrogenous metabolism of the four strains, on peptone, asparagin, and sodium nitrate media. The results showed that variations in the nitrogen source bring about changes in the growth curves.

All the four forms showed a close relationship between growth, utilization of sugar, and acid production on peptone and asparagin, but not on sodium nitrate medium. On peptone, where growth is most rapid, there is a marked production of acid and a corresponding rapid utilization of sugar. On asparagin the same phenomena are observed, but on the sodium nitrate medium, although growth is considerable and sugar is utilized, there is no appreciable accumulation of acid. *Botrytis* IX and IV, the most rapid growers, also showed the greatest accumulation of ammonia on both asparagin and peptone media. The production of ammonia was accompanied by a corresponding decrease in the amino nitrogen content of the medium, indicating that the major portion of the ammonia nitrogen is formed directly from the amino groups. On sodium nitrate, when no amino nitrogen is present, no ammonia accumulates.

The so-called 'sparing effect' of carbohydrates on protein utilization was demonstrated; cultures on peptone plus 1·5 per cent. sugar producing much more ammonia (with corresponding utilization of protein) than on the peptone medium plus 3·0 per cent. sugar.

As regards amino nitrogen, forms IX and IV on the peptone medium showed a final accumulation of amino nitrogen considerably less than the initial, whilst in the case of forms I and VII it was considerably greater. The growth, total nitrogen of mycelium, acidity, sugar utilization, ammonia, and especially amino nitrogen curves demonstrate that forms IX and IV are more closely related to each other than to either forms I or VII.

The second part of the paper deals with the morphology of the strains under various conditions. The results of further cultural studies on peptone synthetic, maize, and potato agars showed that the amount and type of growth are affected by temperature and substratum. Irrespective of temperature, a much heavier mycelial growth was produced by all forms on peptone agar than on the other media, while sclerotial development was also promoted. At 27·5° C. sclerotial production was practically inhibited, the few fructifications being submerged, whereas at 18°, and generally at 22°, they were superficial.

Botrytis VII and I, though members of one group as regards type of growth, do not show such a close relationship as forms IX and IV. All forms, irrespective of medium, produced at 27·5° abundant microconidia formed on short, depressed, lateral branches, on an elongated, branched, and creeping conidiophore. The effect of temperature on the growth of all forms was much less pronounced on maize than on potato or peptone agars.

The results of spore germination studies showed that all four forms germinate better at 22° and 27° than at 18°. The average conidial measurements were as follows: I, 9 to 15 by 8 to 13 μ; IV, 12 to 19 by 8 to 15 μ; VII, 8 to 13 by 7 to 10 μ; and IX, 12 to 19·5 by 9 to 15 μ. On this basis, therefore, as well as on rate of

germination (forms IX and IV germinating much faster than VII and I), cultural characters, and nitrogen metabolism, forms VII and I and forms IX and IV fall into two distinct groups.

Cross-inoculation tests with all four forms on geranium, lettuce, cyclamen, squash, cucumber, sunflower, hemp, and turnip gave positive results in each case. *Botrytis* I and VII produced normal, erect conidiophores on the blackened and damp host tissue, while IV and IX also formed superficial mycelium, corresponding to the growth of the various forms in culture.

T[UNSTALL] (A. C.). **A few notes on blister blight.**—*Quart. Journ. Indian Tea Assoc., 1926,* 1, pp. 42–43, 1926.

Brief directions are given for the control of blister blight of tea (*Exobasidium vexans*) in north-eastern India. Two or more inspections at intervals of 10 to 11 days should be made and diseased leaves plucked off and buried on the spot. If any disease be found at the third examination, the affected bushes should be sprayed twice at an interval of 10 to 11 days with lime-sulphur solution [see this *Review*, v, p. 194] and any tea bushes found in the jungle in the vicinity of the diseased bushes eradicated. All attempts to check severe attacks of the disease in the rainy season are futile, but in such cases the young and pruned bushes should be protected from infection during the critical period by the application of a fungicide at intervals of ten days. In the isolated gardens of Assam the disease can be eradicated during the cold weather, but in Darjeeling this operation is more difficult owing to the close proximity of the gardens. A recent examination of over 60,000 tea seeds, many from infected gardens, failed to reveal a single case of contamination by *E. vexans*, so that the risk of the disease being transmitted by the seed is very slight [see also this *Review*, iv, p. 509].

BONDARTZEVA-MONTEVERDE (Mme V. N.). **Phytophthora infestans (Mont.) de By** на Томатах. [*Phytophthora infestans* (Mont.) De By on Tomatoes.]—Reprinted from *Morbi Plantarum*, Leningrad, xv (*1926*), 1, 27 pp., 1926. [German summary.]

Tomatoes [the commercial cultivation of which in the open is stated to be steadily increasing in the neighbourhood of Leningrad] suffer severely in some years from a dry rot of the still green fruit. The first symptom appears as a small, subepidermal, brown spot, which increases in size until the whole fruit is involved. The latter remains firm, with the cuticle smooth and unbroken, though very occasionally small depressions may be seen on the surface. In the field, conidiophores are observed very rarely, and then only on almost ripe tomatoes growing close to the ground and covered by leaves. A feature of the disease is the almost entire absence of foliage infection even on heavily diseased plants.

The causal organism was isolated and grown in pure culture on various media. A detailed discussion of its morphological and cultural characters leads the author to identify it as *Phytophthora infestans*, in which opinion she is confirmed by successful cross-inoculations on the potato, and vice versa. Germination tests of seed from infected fruits showed that while germinability is

strongly impaired, the plants raised from such seed remain free from infection. Tests for resistance indicated that varieties with spherical, smooth fruits are most resistant, especially John Bear, Maincrop, Sunrise, Victory, and Matchless. Good results in the control of the disease were obtained by spraying the plants with 1 per cent. Bordeaux mixture at intervals of 10 to 12 days, a treatment which also controlled a bacterial wet rot of the fruit. Applications of Bordeaux mixture of various concentrations to the soil around the plants failed to give any control.

In 1922 *Phytophthora infestans* was also recorded on *Solanum melongena* and *S. dulcamara* in Leningrad, this being, as far as the author is aware, the first record of the fungus on these hosts in Russia. The fungus from *S. melongena* proved pathogenic to the tomato and potato, but that from *S. dulcamara* gave negative results.

SIMONET (M.). **Note sur une maladie cryptogamique de la Tomate.** [Note on a fungous disease of the Tomato.]—*Rev. Path. Vég. et Ent. Agric.*, xiii, 1, pp. 70–71, 2 pl., 1926.

During September, 1925, tomatoes at Amblainvilliers (Seine-et-Oise) were found to be suffering from a disease caused by *Phoma destructiva* [see this *Review*, i, p. 149]. The fruit dropped prematurely and at the base of the peduncles showed characteristic large, black, circular spots covered with numerous pycnidia of the fungus, which was isolated and cultivated on carrot media and on sterilized dahlia stem.

For the control of the disease the destruction of infected tomatoes and spraying with copper mixtures are recommended.

Tomato leaf spot.—*New Jersey Agric. Exper. Stat. Circ.* 193, 2 pp., 1 fig., 1926.

A description is given in popular terms of leaf spot of tomatoes (*Septoria*) [*lycopersici*: see this *Review*, iv, p. 709], which is estimated to destroy annually 100,000 to 300,000 bushels of the New Jersey crop. Instructions are given for the control of the disease by cultural measures and the application, at 10- to 14-day intervals, of 5–5–50 Bordeaux mixture, using 100 to 150 galls. of spray per acre.

El impuesto para la defensa contra las plagas del campo. [The tax for protection against crop pests.]—*Bol. Estac. Pat. Veg.*, i, 2, pp. 72–75, 1926.

The Spanish Royal Decree of 20th January, 1926, authorizes the collection of a tax, not exceeding 0·5 per cent. of the net total land value, to be applied for the advancement of the protection of crops against diseases and pests.

IMPERIAL BUREAU OF MYCOLOGY

REVIEW

OF

APPLIED MYCOLOGY

Vol. V | DECEMBER | 1926

Liese (J.). **Achtet auf den Buchenkeimlingspilz!** [Beware of the Beech seedling fungus!]—*Forstarch.*, ii, 14, pp. 217–218, 1926.

The wet weather during June is stated to have promoted an epidemic [in Germany] of the beech seedling disease caused by *Phytophthora omnivora*, which produces dark brown spots on the stems, cotyledons, and foliage, and eventually kills the young trees. The life-history of the fungus and its mode of dissemination are briefly described, and recommendations are made for its control by cultural measures, possibly supplemented by spraying with Bordeaux mixture. Infected sites should not be used again for beech seedlings for some years, since the resting spores of the fungus form a source of abundant contamination.

Yossifovitch (M.). **Le dépérissement du Chêne (Quercus pedunculata Ehrh.) dans les forêts de Slavonie (Yougoslavie).** [The dying-off of the Oak (*Quercus pedunculata* Ehrh.) in the forests of Slavonia (Jugo-Slavia).]—*Rev. Eaux et Forêts*, lxiv, 6, pp. 288–291, 1926.

During 1925 the writer, acting on behalf of the Jugo-Slavian Ministry of Forests and Mines, made an extensive survey of the celebrated Slavonian oak forests (*Quercus pedunculata*), which since 1910 have been steadily declining in vigour and dying off as a result of desiccation [see this *Review*, v, p. 456]. In the parish of Brod alone, the incidence of affected trees rose from 765 in 1910–11 to 172,663 in 1911–12. At present the disease is estimated to extend over an area of more than 50,000 hect., involving over 1,000,000 cu. m. of timber. The writer's researches have so far revealed the presence, in every one of the individuals examined, of the rhizomorphs of *Armillaria mellea*, which is thought to have caused the final destruction of trees already weakened by the successive attacks of caterpillars (especially *Liparis dispar*) and mildew (*Oidium*) [*Microsphaera quercina*].

GALLOWAY (B. T.). **The search in foreign countries for blight-resistant Chestnuts and related tree crops.**—*U.S. Dept. of Agric. Circ.* 383, 16 pp., 5 figs., 1926.

Notes are given on the following possible substitutes for the native American chestnut (*Castanea dentata*), which are being introduced in the hope of replacing those destroyed by blight [*Endothia parasitica*]: the Chinese hairy chestnut (*C. mollissima*), of which over 10,000 seedlings have been distributed in the United States during the past ten years; European chestnut (*C. sativa*), which is susceptible to blight; the Chinese timber and Chinese dwarf chinquapins (*C. henryi* and *C. seguinii*), both apparently resistant to blight; the Japanese chestnut (*C. crenata*); and the evergreen chinquapins (*Castanopsis delavayi*, *C. hystrix*, and other species) from Yunnan, China.

Horse-Chestnut leaf blotch.—*New Jersey Agric. Exper. Stat. Circ.* 197, 1 p., 1926.

An account is given in popular terms of the leaf blotch [*Guignardia aesculi*] of horse chestnut [*Aesculus hippocastanum*] which is said to be very prevalent in New Jersey. Spraying with lime-sulphur 1 in 40 or dusting with sulphur-lead arsenate dust 90–10 are suggested as practicable control measures in the case of valuable trees, the first application being given as soon as the buds open, followed by at least two more at intervals of two or three weeks.

Maple leaf scorch.—*New Jersey Agric. Exper. Stat. Circ.* 196, 2 pp., 1926.

Maples [*Acer* spp.] are stated to be very susceptible to leaf scorch owing to their habit of coming out early and bearing large, thin leaves. The symptoms may appear in the form of intervenous streaking, followed by a yellowing of the entire leaf, or as blotches of variable dimensions. Leaf scorch is particularly severe on soft and sugar maples [*A. saccharum*] and the red Japanese variety [*A. palmatum rubrum*], and is most prevalent on trees growing at the edge of pavements. The Norway and Red maples [*A. platanoides* and *A. rubrum*] are comparatively resistant.

The condition is attributed to disturbances in the water balance of the tree resulting from excessive transpiration in hot weather [see also this *Review*, i, p. 431]. The most satisfactory control is obtained by pruning off, during the dormant period, 25 per cent. of the branches close to the trunk [ibid., iv, p. 355]. In the spring a good fertilizer should be applied, and during the hot, dry weather the soil for some distance round the trees should be watered at regular intervals.

MURRAY (B. JEAN). **Three fungous diseases of Salix in New Zealand and some saprophytic fungi found on the same hosts.**—*Trans. New Zealand Inst.*, lvi, pp. 58–70, 4 pl., 10 figs., 1926.

In this paper a full description is given of three of the worst diseases of willows occurring in the Nelson district of New Zealand.

Marssonina salicicola occurs chiefly on the weeping willow (*Salix babylonica*: on which host it was also seen by the author in

South Australia in 1924 and 1925), but also on the crack willow (*S. fragilis*). The fungus produces a pale reddish-brown spotting of the leaves, and brown cankers on the twigs, whilst badly diseased trees almost lose their 'weeping' habit on account of a shortening of the internodes. The leaves are smaller than normal, and frequently fall prematurely. Whitish acervuli, from 150 to 200 μ in diameter when mature, are produced on the spots, breaking through the epidermis to liberate the hyaline, bicellular conidia. These are club- or pear-shaped, frequently curved, and measure 11 to 16 by 3 to 7 μ. The parasite agrees in all important features with *M. salicicola*, of which *M. rubiginosa* and *M. nigricans* are thought to be merely variant forms. The disease of willows recorded by Fukushi in 1921 from Japan as probably due to a *Marssonina*, may also prove to be identical with the New Zealand disease.

Macrophoma salicis attacks *S. fragilis*, causing a reddish-brown discoloration of the tips of the infected leaves. This is somewhat sharply delimited from the healthy tissue, which ultimately becomes yellow, the leaves falling prematurely. Pycnidia are more or less thickly distributed over the diseased areas. They are somewhat similar in colour to the dying leaf tissue, 100 to 170 μ broad, globose or flattened globose, deeply sunken, amphigenous, and with a short broad papilla, opening by a circular pore. The pycnospores are oblong with rounded ends, continuous, hyaline, and 16 to 20 by 6 to 8 μ.

Gloeosporium capreae is of most frequent occurrence on the leaves of *S. fragilis*, although not unknown on *S. babylonica*. It causes small, round or irregular, somewhat raised spots on the upper surface of the leaf, greyish-white with a narrow, dark brown margin, often confluent and then forming large irregular patches. The spots are covered with minute, black dots, representing acervuli, which are chiefly confined to the upper surface. These are brown, often confluent, and measure 80 to 120 μ in diameter. They produce small, oblong to oval, hyaline, unicellular conidia, 8 to 12 by 3 to 6 μ in diameter.

The name *Gnomonia bullata* n. sp. is given to a fungus [which is fully described] commonly found on willow branches which have died the previous season. It is thought to be possibly the ascigerous stage of *Marssonina salicicola* or *Gloeosporium capreae*, but cultural evidence of this has not been obtained.

The following saprophytic fungi were also found on willows in the Nelson district: *Cryptodiaporthe salicella*, (?) *Leptosphaeria salicinearum*, *Metasphaeria orthospora*, *Pleospora herbarum*, *Macrophoma salicaria*, *Diplodia salicina*, *Coryneum salicis*, *Hyaloceras saccardoi*, and *Pestalozzia funerea*.

BURLET (F.) & GROSCOLAS. **Observations sur la présence du Pleurotus eryngii à St.-Jean-de-Belleville en Tarentaise (Savoie).** [Observations on the occurrence of *Pleurotus eryngii* at St.-Jean-de-Belleville in Tarentaise (Savoy).]—*Bull. Soc. Myc. de France*, xli, 4, p. 475, 1926.

In a natural habitat of *Pleurotus eryngii* [see this *Review*, v, p. 176] visited by the authors in September, 1925, the fungus appeared to grow with the same facility on the rootstocks of

Eryngium alpinum as on those of *Laserpitium latifolium* in those places where the latter grew mingled with the former. In adjacent fields, however, where *L. latifolium* was not in association with *E. alpinum*, the fungus was totally absent. It was also noted that *P. eryngii* was as abundant in mown as in unmown meadows, and that it frequently occurred on partly decayed rootstocks of the hosts, even when these were capable of producing a vigorous growth in the following year.

CURTIS (KATHLEEN M.). **A die-back of Pinus radiata and P. muricata caused by the fungus Botryodiplodia pinea (Desm.) Petr.**—*Trans. New Zealand Inst.*, lvi, pp. 52–57, 2 pl., 7 figs., 1926.

The author describes in some detail an apparently unrecorded disease caused by *Botryodiplodia pinea* on *Pinus radiata* and *P. muricata* in the Marlborough and Nelson districts of New Zealand.

A striking feature of the disease is the dying off of the tip of the stem or of one or two of the higher branches. The disease then extends downwards as much as 20 feet, though the lowest branches are not usually affected. The surface of the bark is not sunken or distorted, but after a time pycnidia are developed on it, either singly or in groups. The cones also are attacked, but the pycnidia borne on them are scattered. On splitting the badly diseased stem, the bark and cortex are found to be dark brown or nearly black, the xylem ash coloured, and the pith rusty brown to pure black. Infection is always more marked at the nodes where the cones are attached. The pycnidia are black, erumpent, thin-walled, angular to rounded, from 250 by 250 to 800 by 800 μ, with a shortly papillate ostiole. The pycnospores are ellipsoid-obovate to cylindrical with rounded ends, fuliginous to fuscous when mature, non-septate (uniseptate in older pycnidia), and measure 24 to 37 by 14 to 18 μ.

The fungus, which possibly infects only through wounds, is an active parasite when once established. In some cases it appears to enter by the cones or cone-stalks, whilst in others it attacks the branch directly. The hyphae are at first hyaline, but later turn black, especially when near the surface of the stem. Intercellular hyphae with small papillate outgrowths also occur. A black stromatic mass is formed outside the xylem, which the hyphae eventually penetrate by way of the medullary rays.

For the control of the disease it is suggested that diseased parts should be removed two feet below the visibly infected region and the cut dressed with Stockholm tar.

HÖSTERMANN (G.) & KORDES (H.). **Die Schüttekrankheiten der Koniferen und ihre Bekämpfung.** [The leaf fall diseases of conifers and their control.]—*Gartenwelt*, xxx, 23, pp. 360–362; 25, pp. 391–392, 1926.

Defoliation of conifers may be caused by various species of *Lophodermium*, *Hypoderma*, and *Hypodermella*, of which those belonging to the first-named genus are stated to be the most important under German conditions.

Leaf fall of pines, caused by *L. pinastri* [see this *Review*, v, p. 455], is confined almost exclusively to one- to three-year-old trees of *Pinus silvestris*, *P. montana*, *P. nigra*, and *P. cembra*. Trees

originating in Finland and Sweden have been found generally more resistant to leaf fall than those indigenous to central Europe, while individuals from the Auvergne mountains, the Tyrol, and Hungary have proved highly susceptible. The symptoms of the disease and mode of infection are briefly described [loc. cit.].

L. macrosporum causes a similar disease on 10- to 40-year-old stands of *Picea excelsa*. In the spring the previous season's needles assume a rusty tinge, and during the summer perithecia develop on the affected parts, reaching maturity in the following spring. The fact that infected needles do not usually fall off after drying up is attributed to the invasion of the abscission layer by mycelium.

A brown discoloration of the two-year-old needles of *Abies alba*, which occurs from May to July, is due to *L. nervisequum*. The perithecia are not usually found until the needles have fallen. This disease, though very prevalent, is stated to be seldom serious.

P. excelsa and *P. omorica* in Grunewald and Dahlem (Berlin) are stated to be suffering severely from the attacks of a species of *Lophodermium* [unspecified]. The first sign of the disease, observed in September, 1925, on the 15- to 20-year-old trees, was a yellowish-brown discoloration of the needles. Defoliation had not occurred by the middle of March, 1926, and no apothecia were formed.

For the control of leaf fall diseases the writers recommend, in addition to various cultural measures, several applications of a 2 per cent. lime-sulphur, Burgundy mixture, or other copper-containing preparation, with the addition of 1 to 2 per cent. soft soap. The first application should be given in April and subsequent ones at two- to three-weekly intervals from June till the autumn.

NAGEL (F.). **Etwas über Schüttebekämpfungsmittel.** [Notes on preparations for the control of leaf fall.]—*Der Deutsche Forstwirt*, viii, 75, pp. 797–799, 1926.

The writer has tested four preparations for the control of leaf fall of conifers [*Lophodermium*, *Hypoderma*, and *Hypodermella* spp.: see preceding abstract], namely, Bordeaux mixture, Heufeld Burgundy mixture (E. E. Neumann, Eberswalde), Hartwig's (copper) Schüttesalz, and Bordola paste, of which the second is specially recommended on the grounds of efficiency and economy (average cost of 250 l. of mixture, M. 4). Particulars of the composition and application of each of the preparations are given.

LONGYEAR (B. O.). **The nature of decay in wood.**—*Colorado Agric. Exper. Stat. Bull.* 307, 58 pp., 5 figs., 23 graphs, 1926.

In the first part of this comprehensive study, a number of interesting data relating to annual losses from timber decay in the United States and elsewhere are assembled. According to the most recent estimate (1924) the total annual loss from this cause amounts to 16 per cent. of the total cut, i. e., 3·5 billion cu. ft., representing a value of over $200,000,000. In connexion with the causes of decay, a detailed account is given of the anatomical structure, chemical composition, physical and mechanical properties, and other characteristics of wood, together with observations on the life-history of wood-destroying fungi and on some of the effects produced by them.

A description is also given of the writer's method of estimating the rate of decay, based on the progressive loss of weight, after drying to a constant moisture content, of healthy specimens subjected to conditions favourable for decay. Sets of wood specimens of one species and each of equal volume were used, thus permitting of examination at the close of stated periods. The relation of decay to strength was ascertained by testing the strength of each piece after drying and weighing. Details are given of the application of this method to a number of soft and hard woods.

A bibliography of 50 titles is appended.

HARKOM (J. F.). **Some problems in wood preservation.**—*Pulp and Paper Mag. of Canada*, xxiv, 24, pp. 719–720, 1926.

In this paper (read before the Ninth Agricultural Convention of Chemists at Montreal on 3rd June, 1926) the writer discusses some of the problems connected with the preservation of timber. Decay due to fungi is stated to be by far the most important factor in the deterioration of wood used for industrial purposes. The preservatives in most general use at present are stated to be creosote, zinc chloride, and sodium fluoride. It is estimated that only about 50 and 27 per cent. of the annual replacements of railway sleepers in the United States and Canada, respectively, are treated with preservatives. Possibly this is partly due to the facts that about 50 per cent. of the creosote used in America has to be imported [see this *Review*, v, p. 200], and that the water-soluble preservatives leach out and cannot be successfully used in damp localities.

Attempts have been made to use various substances in connexion with timber preservation, including emulsions of creosote and zinc chloride, dilutions of creosote and tar and of creosote and crude oil, and crude oil and zinc chloride (double treatment) [ibid., v, p. 399]. Emulsions of crude oil and zinc chloride are now being tested on a semi-commercial scale. The mixtures of creosote and crude oil in use are stated to range from 30 : 70 to 70 : 30. The lighter fractions of creosote are the most toxic.

KOBBÉ (W. H.). **Indurating wood with sulphur.**—*Chem. & Metall. Engin.*, xxxiii, 6, pp. 354–356, 2 figs., 1926.

A recent development in the work of timber preservation is described. The process consists of immersion in a sulphur bath at a temperature of 140° to 150° C. for five or six hours (or until all moisture is absorbed), after which the temperature is allowed to drop to 120° or 125° for the remainder of the treatment (four or five hours). Experiments have been conducted with a number of hard and soft woods and palms. California redwood [*Sequoia sempervirens*] absorbs approximately its own weight of sulphur, while Florida palmetto [*Sabal palmetto*] absorbs about the same as white pine [*Pinus strobus*], or 60 to 70 per cent., but requires a much longer period of immersion.

Treated pine-wood was found to withstand compression of 5,800 lb. per sq. m. compared with 3,500 lb. per sq. m. for untreated timber. Treated wood is also several times harder than untreated (300 to 350, compared with 100, for hemlock [*Tsuga* spp.]).

Sulphuring prevents the action of at least two of the three

factors, heat, moisture, and oxygen, which are essential to the development of wood rot, and is therefore of great value as a preservative, protecting the wood by physical rather than chemical means.

Experiments are in progress, with the co-operation of the Texas Gulf Sulphur Company, on the application of this method of preservation to sleepers on the Atchison, Topeka, and Santa Fé Railway.

Koppe (A.). **Mittel zur Erhöhung der Holzdauer.** [Methods of increasing the durability of timber.]—*Illus. Landw. Zeit.*, xlvi, 20, p. 253, 1926.

The following points in this brief account of current methods of timber preservation are of interest. Carbolineum should not contain more than 15 per cent. cresol, since preparations with a higher proportion are apt to injure the fibres. Tar should be applied only to underground portions of the timber, since its absorption of heat leads to cracking of the exposed parts. A similar risk is incurred by the practice of burning the upper layer of the wood. One of the best preservative substances is stated to be heavy tar-oil, consisting of cresol, chinolin, naphthalene, and homologues. This preparation, applied warm, has been found approximately equal in efficacy to the mercurial preservatives. The so-called Torrel process is based on the saturation of the wood in a solution of boiling sugar, followed after cooling by the injection of hot air to induce the evaporation of the water left in the timber.

Gäumann (E.). **Ueber die Spezialisierung des falschen Mehltaus (Peronospora brassicae Gm.) auf dem Kohl und seinen Verwandten.** [On the specialization of downy mildew (*Peronospora brassicae* Gm.) on Cabbage and related species.]—*Landw. Jahrb. der Schweiz*, xl, 3, pp. 463–468, 1926.

In continuation of his investigations on the genus *Peronospora* [see this *Review*, iii, p. 241] the writer examined the question of specialization in *P. brassicae* Gäumann [formerly *P. parasitica* f. *brassicae*] on cabbage and related species.

The results of cross-inoculation experiments, in which seedlings were sprayed with spore suspensions and then placed under bell jars for 24 to 48 hours, indicate that *P. brassicae* may be sub-divided into three biologic strains, namely: (1) f. sp. *brassicae*, the chief hosts of which are *Brassica oleracea*, *B. napus*, *B. rapa*, *B. nigra*, *B. juncea*, *B. tournefortii*, and *B. fruticulosa*, but which is capable of producing sub-infections on *Sinapis arvensis*, *S. alba*, *Raphanus raphanistrum*, *R. sativus*, and *Eruca sativa*; (2) f. sp. *sinapidis*, the principal hosts of which are *S. arvensis* and *S. alba*, but which is able to produce sub-infections on all the above-mentioned species of *Brassica* (except *B. rapa* and *B. juncea*) and *Raphanus*, with occasional conidiophore formation on *B. oleracea*; and (3) f. sp. *raphani*, the chief hosts of which are *R. raphanistrum* and *R. sativus*, but which can produce sub-infections on all the above-mentioned species of *Brassica* (except *B. fruticulosa*), as well as on *S. arvensis* and *S. alba*, with occasional conidiophore formation on *B. oleracea* and *B. napus*.

HOFFERICHTER (K.). **Gesteigerte Einnahmen durch Beizen des Saatgutes mit Uspulun.** [Increased returns through seed disinfection with uspulun.]—*Gartenflora*, lxxv, 6, pp. 262–263, 1926.

The writer has obtained excellent results [particulars of which are given] in the control of club-root of cabbage [*Plasmodiophora brassicae*] by immersion of the seed in uspulun according to directions. Only 3 per cent. of infection was recorded on a three-acre field of infested soil.

COONS (G. H.) & EDGERTON (C. W.). **Root rot in Sugar Beets in Louisiana not dangerous.**—*Planter and Sugar Manufacturer*, lxxvi, 25, pp. 488–489, 1926.

The writers examined some samples of diseased sugar beet from Baton Rouge, Louisiana, and expressed the opinion in correspondence [which is reprinted] that infection was due to *Sclerotium rolfsii* and *Rhizoctonia*, both of which can be adequately controlled by suitable cultural measures, including judicious crop rotation.

NATTRASS (R. M.). **White rot disease of Onions.—Immunity trials.**—*Ann. Rept. Agric. & Hort. Res. Stat., Long Ashton, Bristol, for 1925*, p. 109, 1926.

This is a brief report on experiments carried out at Bristol in 1925 on the varietal resistance of onions to white root rot (*Sclerotium cepivorum*). Two rows, each 8 yards long, were sown with seed of the following varieties, in heavily infected land, the number of diseased bulbs obtained being given in each case: Magnum Bonum, 0; Selected Red, 0; Selected Coconut, 0; A1, 0; Cranston's Excelsior No. 8, 1; Ailsa Craig, 1; Strasburg, 3; and Cranston's Excelsior No. 4, 4. The slightness of the attack was attributed to the very dry season.

Celery blights.—*New Jersey Agric. Exper. Stat. Circ.* 195, 2 pp., 1 fig., 1926.

The symptoms of early blight (*Cercospora*) [*apii*] and late blight (*Septoria*) [*apii*] of celery are briefly described in popular terms, and directions are given for the control of both diseases by weekly applications of 3–4–50 Bordeaux mixture or copper-lime dust in the seed-bed, and of 5–5–50 Bordeaux mixture at seven- or ten-day intervals when the plants are established in the field. Two- to three-year crop rotation and deep ploughing under of celery refuse are also recommended. The efficacy of seed treatment and of using three- to five-year-old seed is considered doubtful.

JOCHEMS (S. C. J.). **Aspergillus niger op Katjang Tanah.** [*Aspergillus niger* on Groundnut.]—*Indische Culturen (Teysmannia)*, xi, 12, pp. 325–326, 1 fig., 1926.

Groundnut (*Arachis hypogaea*) seedlings grown at Deli (Sumatra) in a test for resistance to slime disease (*Bacterium solanacearum*) were killed by the attack of *Aspergillus niger*. Inoculation experiments with the fungus isolated from the infected plants gave positive results. Since only about 1 per cent. of the seedlings

were affected, the disease is probably of no economic importance, but further investigations in this connexion are desirable. Possibly the groundnut disease attributed to *Mucor* is really due to *A. niger*.

CARNE (W. M.). **Black spot or anthracnose of the Grape vine (Gloeosporium ampelophagum).**—*Journ. Dept. Agric. Western Australia*, 2nd Ser., iii, 2, pp. 178–182, 3 figs., 1926.

The present paper gives a brief, popular account of anthracnose of the vine, *Gloeosporium ampelophagum*, stated to be an important disease of this crop in Western Australia.

For control [see this *Review*, iv, p. 144] it is recommended that all prunings and loose bark should be burnt and a spray given, as late as possible before the buds burst, of Bordeaux mixture (20–20–40), copper sulphate (20 lbs. in 40 galls.), or sulphuric acid (1 in 10). Applications of Bordeaux (6–6–40) or Burgundy (6–9–40) are advised when the buds are bursting, and if necessary just before blossoming, and after the fruit has set. In wet seasons later sprayings (using 50 galls. water) may also be required.

FISH (S.). **A Grape export problem. Microfungi on granulated cork.**—*Journ. Dept. Agric. Victoria*, xxiv, 5, pp. 316–318, 1926.

The granulated cork used for packing grapes for export has been suspected at times of being contaminated with fungus spores capable of giving rise to rotting of the fruit during transit. In order to test this hypothesis cultures were made from many samples of cork, and it was found that *Rhizopus nigricans* and *Penicillium* spp. were present in all cases and *Botrytis cinerea* in one-third of the number. Inoculations were made on wounded and unwounded grapes with each of these fungi with the result that in two weeks all the bunches except the controls were nests of fungi. *Sterigmatocystis* [*Aspergillus*] *niger*, also occurred on the surface of the grapes of both the experimental and control bunches, indicating that the cork is not the sole source of infection.

Sterilization of badly infested cork showed that *B. cinerea* was easily killed by heat, and *Penicillium* at a higher temperature; while the more resistant spores of *R. nigricans* were only killed when the cork was treated for 20 minutes at 94° C. dry heat. The best results on a commercial scale were obtained by allowing hot air to pass up through a revolving cage containing 50 lb. of cork, for 40 minutes, the exit temperature being 210° C., and 1 lb. of sulphur being added for the last 5 minutes.

It is stated that this infection of granulated cork is not necessarily general, and a sample barrel of Spanish grapes landed in Melbourne early in the year proved to be comparatively free from micro-fungi. To reduce the danger of contamination from the vineyard, it is advised to sulphur the fruit before picking and to give a puff of sulphur to each bunch before packing.

GARBOWSKI (L.). **Choroby roślin uprawnych w Wielkopolsce, na Pomorzu i na Śląsku w r. 1924 i 1925.** [Diseases of cultivated plants in Great Poland, Pomerania, and Silesia in 1924 and 1925.]—Pamphlet of the Publishing Institute '*Bibljoteka Polska*', Bydgoszcz, 47 pp., 1926. [French summary.]

The present report is compiled on much the same lines as those

for previous years [see this *Review*, iv, p. 19; v, p. 211]. The following items are of interest.

Typhula graminum was found in several localities parasitizing the leaves of winter barley in association with *Puccinia simplex*, *Ascochyta graminicola*, and *Cladosporium herbarum*. The sclerotia of the fungus were found not only on and in the tissues of the leaves and haulms, but also on the rootlets of the seedlings and in the soil around the latter. An undetermined species of *Mycosphaerella*, also in association with other fungi, was recorded on wheat, barley, and rye in both the years under review. The perithecia on the withered leaves are densely gregarious, pinkish-brown, translucent, usually somewhat applanate, from 140 to 220 μ in diameter, and with an ostiole about 30 μ broad. The asci are cylindrical-clavate and 52 to 67 by 9 to 9·5 μ; they contain 2-celled spores, 15 to 16 by 3·5 to 4 μ. Besides occurring on barley, *A. graminicola* was also found on wheat and rye. *Septoria graminum* and *S. glumarum* were found on dying leaves of oats attacked by *P. glumarum*, *Erysiphe graminis*, and *C. herbarum*. A new record for Poland is that of *Coniosporium arundinis* var. *secalis* on rye; it was found in 1923 on the remnants of stamens still adhering to the young grain, in the form of black agglomerations (150 to 250 μ in diameter) composed of spores. The latter are rounded, smooth, olive-coloured, and 5·5 to 6·5 μ in diameter.

Peronospora aestivalis was found on cultivated lucerne. In one locality about 10 per cent. of sugar beet seedlings were killed by a root rot caused by *Sclerotinia sclerotiorum*. Sugar beet also suffered in another locality from a leaf spot caused by *Sporodesmium putrefaciens*, which killed the leaves attacked. Chrysanthemums in the hothouses of the Institute of Agriculture in Bydgoszcz showed a black spotting of their lower leaves; the spots were for the most part located between the leaf veins and sharply delimited from the surrounding healthy tissues. The disease rapidly spread and led to the death of the plants attacked. Microscopic examination showed the presence in the intercellular spaces in the leaf tissue of an undetermined bacterium.

Among diseases of forest trees, those caused by *Armillaria mellea* and *Polyporus* [*Fomes*] *annosus* are stated to be very widespread. In one locality the first-named was found killing 6- to 10-year-old pines. In the Rychtał forest an area of 200 hectares of mixed stand had to be cut down as almost all the trees were attacked by *F. annosus*, and reports have been received from a number of other forest districts where the fungus is killing whole stands of pines and birches. Equally widespread in pine forests is *Lophodermium pinastri*, chiefly in its *Leptostroma pinastri* stage. Experiments to control this disease by spraying the trees with Bordeaux mixture gave negative results.

MOROZOV (B.). Обзор грибных и бактериальных болезней сельскохозяйственных растений в Калужской губернии за **1924** год. [A survey of fungal and bacterial diseases of agricultural plants in the government of Kaluga in 1924.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 592–602, 1926.

Brief notes are given on the principal diseases of cultivated

plants which were recorded in 1924 in the government of Kaluga [central Russia], of which the following are of interest.

Urocystis occulta was found practically over the whole region, but only did slight damage to the rye crop. Slight outbreaks of *Tilletia secalis* occurred on rye in some localities, but did not injure the crop to any appreciable degree. Spring-sown rye suffered more than usual from *Claviceps purpurea*, from 5 to 10 per cent. of the ears being infected. In one locality where the crop was sown on heavily manured land, which favoured the development of the fungus, 36 per cent. of the ears were attacked. *T. tritici* was very prevalent in some districts, the percentage of infection of autumn-sown wheat varying from 0·60 to 4·41, while in one district the percentage rose to 13·66 on spring wheat. *Ustilago tritici* chiefly attacked spring wheat and was less widespread than the former, the average percentage of infection being 2·75 for the whole government. The so-called winter injury was very severe in 1924, over 50 per cent. of the autumn sowings having been killed by it in many localities. Oats were severely attacked by *Ustilago avenae* and *U. levis*, the damage done by these smuts averaging from 9 to 15 per cent. Flax, which is one of the chief crops in some districts, suffered fairly heavily from rust (*Melampsora lini*). In one village about 30 per cent. of the cabbage seedlings were killed by *Olpidium brassicae*. *Plasmodiophora brassicae* was very prevalent on cabbage in many localities, in some of which the damage done by this disease amounted to from 40 to 75 per cent. Cucumbers were slightly attacked by *Scolecotrichum melophthorum*, while *Sporodesmium mucosum* was present practically throughout the whole region and caused considerable harm. *Sphaerotheca humuli* was fairly frequent on cucumbers, but did not cause any noticeable loss.

Among the numerous notes on diseases of fruit, forest, and ornamental trees and shrubs, it is stated that the conidial stage of *Mycosphaerella sentina*, producing white spotting of the leaves, was very widespread on the pear and caused a heavy defoliation.

CAMPBELL (J. G. C.). **Report by the Mycologist.**—*Ann. Rept. Fiji Dept. of Agric. for the year 1925*, pp. 12–14, 1926.

Further investigations on the so-called 'Sigatoka' disease of bananas [see this *Review*, iv, p. 554] have shown that the condition may be due to a number of different agents. The name 'Sigatoka' will in future be discontinued as inapplicable and will be replaced by 'leaf spot'. Inoculation experiments with several species of bacteria and fungi associated with the disease gave negative results, and its primary cause still remains obscure.

Freckle of bananas (*Phoma* or *Phyllosticta* sp.) [? *Macrophoma musae*: see below, p. 749] has not previously been described from Fiji. It is characterized by a progressive brown discoloration and death of the leaf tissue from the edge inwards. Small clusters of pycnidia, containing large, unicellular, hyaline spores, develop on the leaf blades, petioles, and fruit. In Hawaii the disease is stated to have been controlled by spraying with Bordeaux mixture.

Anthracnose [*Gloeosporium musarum*] appears to be generally confined to old, bruised fruit, but since it has been shown in the

Philippines [ibid., ii, p. 279] to be capable of attacking bananas in the plantation, precautions should be taken to prevent its spread by the destruction of diseased material.

Thread blight of coco-nuts (*Corticium penicillatum*) [ibid., iv, p. 604] was found during the year on the Vuinasevu River in Vanualevu and at Nasinu. In the latter place the disease is stated to have been readily controlled on previous occasions by spraying with lime-sulphur.

Blast of rice [*Piricularia oryzae*: ibid., i, p. 343] was found, for the first time in Fiji, on the crop round Suva. The loss from the disease is estimated at 25 per cent. at least of the yield. Part of the 'straighthead' condition associated with the disease may have been due to soil conditions, especially partial drought [ibid., ii, p. 31].

Base rot of suckers, leaf spot, and fruit rot of pineapple are all caused by *Thielaviopsis paradoxa*. So far only the first-named form of the disease has been of any commercial importance. The lower end of shoots and suckers is attacked in storage, during transport, and shortly after planting. The bottom of the sucker rots away, destroying the roots, and the plant dies. A large percentage of a consignment is frequently attacked in this way. The remedy for base rot is to dry the bottoms of the suckers in the sun for a week.

Two non-parasitic conditions, wilt and tangle root, were observed in pineapples for the first time. The former is thought to be possibly due to soil conditions, and the latter to the non-removal of the leaf-like scales within an inch of the cut end of the sucker.

Angular leaf spot and black arm of cotton (*Bacterium malvacearum*) occurred in various districts.

A leaf spot of maize, associated with a species of *Helminthosporium*, caused considerable damage in the Ra province.

HARGREAVES (E.). **Report of the Entomological Section.**—*Ann. Rept. Sierra Leone Lands & Forests Dept., for the year 1925*, pp. 16–18, 1926.

The following reference is of mycological interest.

As a result of the distribution of the entomogenous red fungus *Nectria diploa*, there has been a general improvement in the appearance of the coco-nut palms in various parts of Sierra Leone hitherto badly attacked by scale [*Aspidiotus destructor*]. The distribution was made towards the end of the rains, so that the fungus has not yet had time to show its full effect.

EYLES (F.). **Preliminary list of plant diseases recorded in Southern Rhodesia.**—*Rhodesia Agric. Journ.*, xxiii, 7, pp. 629–651, 1926.

This list is compiled from the records of the Mycological Laboratory, Salisbury, and is based mainly on material sent in for examination, in addition to which a certain number of determinations have been furnished from other quarters. The investigation of the plant diseases of southern Rhodesia was initiated less than three years ago, and the list is therefore necessarily incomplete, but it is

hoped that none of the really serious crop diseases has escaped attention.

Brief notes on the general appearance of each disease, the treatment (if any) advised for its control, and the locality whence the specimens were received are given.

BURGER (O. F.). **Report of the Plant Pathologist.**—*Rept. Florida Agric. Exper. Stat. for the fiscal year ending June 30, 1925*, pp. 42R–64R. [1925. Received October, 1926.]

This report contains, *inter alia*, the following items of interest apart from those already noticed in this *Review*.

A study of the life-history of *Fusicladium effusum*, the cause of pecan [*Carya pecan*] scab [see this *Review*, iv, p. 72], was made. It was found that the fungus has an incubation period of from four to nine days, and grows best at 25° C.; sporulation occurs most readily on cornmeal agar, the average measurements of the spores being 18·2 by 6·5 μ. Inoculation tests on pecan seedlings resulted in the production of the characteristic symptoms. The disease is probably carried through the winter on old infected husks and on twigs and old leaves on the ground. The mycelium overwinters on these parts and renews sporulation in the spring. The leaves are susceptible for two weeks after unfolding and the nuts from three weeks after setting to the 'milk' stage. Moisture increases the severity of infection. Young plants are most susceptible, nursery stock, even of resistant varieties, being heavily attacked.

The damage caused by scaly bark of citrus [stated by Fawcett and Lee in their book on Citrus diseases (see below, p. 735) to be quite distinct from the Californian scaly bark or psorosis and to be attributed to *Cladosporium herbarum* var. *citricolum*, while the cause of the Californian disease is unknown] was less severe than in the previous year. The disease does not appear to have spread in the last five years, and is said to be easily controlled by adequate pruning, spraying, and careful nursery inspection.

Investigations on citrus blight, wilt, or leaf curl [see this *Review*, iv, p. 721] have been continued. It was observed that a definite correlation exists between the incidence of this disease and the season of the year and also the moisture content of the soil. All the new cases of blight occurred during the winter or dry season. Two types of wilting are distinguished by the growers, differing in their cause though they produce a more or less identical wilting and curling of the foliage. One type is thought to be induced directly by deficiency of soil moisture, and the trees recover after adequate rainfall. In the other, the cause appears to be root injury consequent on excessive soil moisture. When this condition becomes chronic, affected trees cannot be distinguished from those suffering from true blight. Whether the latter has any existence apart from the types of injury dependent on extremes of soil moisture appears from the investigations so far made to be doubtful. No parasitic organism has been detected in either roots, trunks, or branches of blighted trees, and preliminary experiments indicate that the trouble is not transmitted by grafting or budding. Control must consequently be limited to preventive measures, such as the planting of new groves on selected soils and attention to cultural practices.

Observations indicate that although blight occurs on a great diversity of soil types, it is most frequent on soils underlaid by rock. Increased cultivation of the soil during the dry season and the use of cover crops during the rainy season are recommended.

The area infected with bud rot of coco-nuts extended from the immediate vicinity of Miami as far north as Fort Pierce. Isolations from 760 specimens from 245 different properties revealed the presence of numerous organisms. About 70 of these specimens yielded a *Phytophthora*, the morphology of which agrees closely with Reinking's description of *Phytophthora faberi* [*P. palmivora*]. In many cases the decay was so advanced that isolation of this fungus, if present, would have been impracticable. The disease due to this organism seems to be confined to nurseries and young palms. Bud rot in bearing palms was in almost every case due to *Thielaviopsis* [*paradoxa*].

Tomatoes suffered severely from nailhead rust (*Macrosporium solani*) [*M. tomato*: ibid., v, p. 598]. The most resistant varieties were Marglobe, Marvel, Norton, and Marvana. Spraying with Bordeaux mixture (4–4–50) gave the best control.

Corticium stevensii on pear trees was effectively controlled by the applications of 4–4–50 Bordeaux mixture, and the same was true of the fig rust (*Physopella* [*Kuehneola*] *fici*).

Cotton variety tests were commenced to determine their resistance to cotton wilt (*Fusarium vasinfectum*). The varieties Cooke 307–6 and Council Toole appear the most promising both as to yield and resistance, while a number of others are listed as exhibiting a high degree of resistance. Amongst these, Lightning Express was selected as a basis for breeding work in consideration of its combined qualities of wilt resistance, earliness, and length of staple.

Rhizoctonia [*solani*] appeared late in the cotton fields, killing plants which were 8 to 12 inches high by girdling them just below soil level during a rainy spell in May. Angular leaf spot [*Bacterium malvacearum*] and *Diplodia* [*Physalospora gossypina*: ibid., v, p. 90] boll rot caused considerable damage during the autumn of 1924, some of the varieties having a large percentage of the bolls destroyed by these parasites.

Botany and plant pathology.—*Thirty-ninth Ann. Rept. Pennsylvania Agric. Exper. Stat. for the year ending June 30, 1926*, pp. 14–18, 1926.

The present report is on the same lines as those for preceding years [see this *Review*, iv, p. 81; v, p. 81]. The following notes on plant diseases are of interest.

During the spring of 1925 a concentrated effort was made to discover the organism causing the 'frog eye' leaf spot of apple [usually attributed to *Physalospora cydoniae*, but see ibid., iv, p. 15]. All organisms found in and around an orchard known to have been severely affected with the disease in 1924, and which could be induced to sporulate, were used in inoculation experiments conducted both in the open and in laboratory chambers in which the humidity was controlled, but all the experiments failed to yield distinctly positive results. Natural incidence of the disease was,

however, very high in that orchard in 1925, the trees being almost totally defoliated by midsummer. Further work on this problem is in progress.

The results of extensive inoculation experiments in 1925 with material from overwintered leaves showed conclusively that [*Phoma pomi*], the cause of apple fruit spot, is a stage of *Mycosphaerella* [ibid., v, p. 432]. Investigation of its life-history showed that leaf infection may, and not infrequently does, occur while the foliage is still on the trees, and that fruit infection can take place much earlier in the spring and much later in the autumn than was formerly supposed. The latter is much facilitated by high humidity. The part played by ascospores in the infection of leaves and fruit has not yet been fully elucidated.

A survey of conditions in various mushroom houses showed that *Mycogone perniciosa* [ibid., iv, p. 167] is probably the most important fungous parasite of cultivated mushrooms [*Psalliota campestris* and *P. arvensis*] in Pennsylvania. Further, a fungous growth locally known as 'flour mould' found on the compost is responsible for a considerable reduction in the yield of the beds, and a bacterial spot of the mushroom caps has also some economic importance.

The promising results in the control of crown rot of rhubarb [*Phytophthora cactorum* : ibid., ii, p. 433] by the selection of resistant plants and by root selection for freedom from infection were confirmed by the fact that the additional loss during 1925 in the experiment plots begun in 1924 was considerably below one per cent. In 1925, early spring plantings of selected roots produced a stand that was only slightly below perfection. In plots dusted twice with copper-lime dust, 3 per cent. died and 1·1 per cent. more showed symptoms of crown rot, while in the untreated plots 3·3 per cent. died and 5 per cent. more exhibited symptoms of the disease. It was further shown that copper-lime dust was as effective as Bordeaux mixture in checking the spread of crown rot.

Observations on growth and weather conditions in relation to *Botrytis* rot of lettuce indicated that the alternation of great temperature extremes combined with rapid succulent growth is most important in predisposing the lettuce to infection in cold frames. Control depends chiefly on the regulation of cultural conditions.

The investigation of two bacterial diseases of the Lima bean [*Phaseolus lunatus*], which cause a red and a brown spotting of the leaves, showed that the former is due to an organism agreeing with *Bacterium viridifaciens* in cultural characteristics except for two minor details, and that the latter is produced by an organism which appears to be *Bact. phaseoli*. Infection with both organisms was secured with and without wounds.

TALBERT (T. J.). **Horticulture.** [*ex* 'Some new developments in agricultural science: one year's work, Agricultural Experimental Station (Report of the Director; July 1, 1924, to June 30, 1925).]—*Missouri Agric. Exper. Stat. Bull.* 236, pp. 59–63, 1926.

The following references of phytopathological interest [con-

tributed by various collaborators whose names are mentioned in connexion with each investigation] are contained in this section of the report. The cultivation of early cabbage on land which has once become infected by *Fusarium conglutinans* is attended by serious losses. These were much lower in 1924 than in 1923, probably owing to the early date of planting and the relative coolness of the growing season. Relatively high soil temperatures favour the growth of the causal organism [see this *Review*, iii, p. 510], and very early plantings may therefore materially reduce the loss on infected soils.

Tanglefoot again proved the most efficacious of all the materials used for the covering of wounds on apple trees caused by the excision of blister cankers [*Nummularia discreta*: ibid., v, p. 149]. No material or treatment has been found to prevent the development of the disease, which has reappeared after two years in practically all the treated trees.

Missouri selections of the Marvel and Norton tomato varieties have shown the highest degree of resistance to wilt (*F. lycopersici*) of all the 42 strains and varieties tested. The Bonny Best was the most susceptible commercial variety grown on infected soil.

The best control of *Rhizoctonia*, blackleg, and common scab of potatoes [*R. solani*, *Bacillus atrosepticus*, and *Actinomyces scabies*] was given by four minutes' immersion in a solution of 1 pint commercial formaldehyde to 15 galls. of water heated to 122° to 124° F.

Colloidal copper hydroxide preparations [ibid., iv, p. 559] have been developed and tested as fungicides on apples, peaches, and cherries. The results of three years' work have shown that the Missouri cold-mix lubricating oil emulsions [ibid., iv, p. 549] are less expensive, easier to prepare, and more stable than the boiled oil soap emulsions, besides being compatible with any of the standard spray mixtures. Lubricating oil emulsions caused no injury to dormant fruit trees when the concentration of the oil was below 5 per cent. Combinations of both the cold-mix and boiled oil emulsions have been used in concentrations of 1 and 2 per cent. with lime-sulphur-lead arsenate and Bordeaux-lead arsenate from the time of the appearance of the leaves in the buds up to the blooming period, without appreciable injury to fruit buds or leaves. It would appear to be safe to delay the application of these combination sprays till the pre-cluster bud or cluster bud stage for the control of apple scab [*Venturia inaequalis*], black rot [*Physalospora cydoniae*], and insect pests. In general, a 2 per cent. oil combination spray causes too much injury to apple fruit and foliage to be safely used at or after the calyx stage, but 1 per cent. mixtures may usually be applied without serious risk during the summer, except at the calyx period, when Grimes and King David apples are liable to severe damage. The method of making Bordeaux mixture has no effect on the amount of burning on foliage or fruit. Severe burning often followed applications of 3–4–50 Bordeaux mixture 10 to 14 days after the calyx spray. Bordeaux mixture also tended to inhibit the growth of apple foliage and fruit.

It was found necessary to use the maximum amount of dry lime-sulphur, and in some cases one-quarter to one-half more than

the quantity usually recommended by the manufacturers, in order to obtain comparable results in the control of insect pests and fungous diseases with those ordinarily given by liquid lime-sulphur. The cost of an adequate application of dry lime-sulphur was 50 to 75 per cent. greater than that of the solution, the control of apple scab being approximately equal in both cases.

BOLLEY (H. L.). **Biology.**—*Rept. for the biennium July 1, 1923, to June 30, 1925, North Dakota Agric. Exper. Stat. Bull.* 194, pp. 39–50, 3 figs., 1926.

This report contains the following references of phytopathological interest, other than those already noticed from different sources. It is estimated that 30 to 40 per cent. of the flax planted in the State is resistant to wilt [*Fusarium lini*], and the exclusive use of resistant varieties should rapidly effect the elimination of wilt as a reducing factor in the crop. Some results of studies in the transmission of resistance to wilt and rust [*Melampsora lini*] are described. The variety N.D.R. 119 (Buda) is equal to the already established N.D.R. 114 in resistance to wilt, and superior in rust resistance. The seeds of two varieties, respectively resistant and susceptible to wilt, were found to contain globulins, immuno-chemically distinct from one another, but *F. lini* grew equally well on both when used with purified waterglass as culture media.

The application of calcium cyanamide, at the rate of 100 to 250 lb. per acre, has given promising results in the control of flax wilt, wheat scab [*Gibberella saubinetii*], and potato scab [*Actinomyces scabies*] on old, 'sick' soils.

Heat canker of flax [see this *Review*, ii, p. 313] is stated to be more or less controllable by cultivation in rows 18 to 20 inches apart, keeping a light mulch round the roots of the young crop.

Extensive cytological investigations of the tissues of Early Ohio potato tubers affected by stem end discoloration demonstrated that the blackleg bacterium [*Bacillus atrosepticus*] may be associated with the wilt organism (*Fusarium oxysporum* var. *longius*) in the same tuber, both being involved in the causation of the disease. *F. discolor sulphureum* and other species of *Fusarium* were frequently isolated from the diseased tissues.

Good control of black point disease (*Helminthosporium sativum*) on Monad wheat [ibid., iii, p. 702] has been obtained by one to two hours' immersion of the seed-grain in solutions of uspulun or chlorophol, together with crop rotation, seed selection, and the use of resistant varieties. In 1924 many fields of durum wheat, especially in the north-west of the State, were heavily infected (up to 50 per cent.) by *H. sativum*, which caused a whitening of the stalks resulting from obstruction to the passage of moisture and food substances from the soil. The same fungus also causes a blighting of the blades and glumes closely resembling that occurring on barley.

The results of experiments carried out for four years in the control of bunt of wheat [*Tilletia levis*] have shown the efficacy of solutions of uspulun, chlorophol, semesan, and tillantin C, and of copper carbonate dust. The cost of the organic mercury compounds is ten times as high (per bushel of seed-grain) as formaldehyde, but

they are recommended for the control of scab and black point of wheat and other semi-internal cereal diseases. Copper carbonate (4 oz. per bushel) costs about five times as much as formaldehyde, but is the cheapest and most effective dust for the control of external infection.

Plant diseases.—*Thirty-eighth Ann. Rept. South Carolina Agric. Exper. Stat. for the year ended June 30, 1925*, pp. 51–55, 1 fig., 1925. [Received 1926.]

The average annual loss from fungous and bacterial diseases of plants in South Carolina is estimated at $15,000,000 to $20,000,000. During 1925 there was a considerable reduction in the amount of disease compared with 1924, owing to the dry weather.

Ascochyta canker of cotton [*A. gossypii*: see this *Review*, ii, p. 215], first observed in South Carolina in 1924, was again noticed in a scattered form.

Cotton wilt [*Fusarium vasinfectum*] continues to increase in prevalence in almost all sections of the State. The use of the wilt-resistant Dixie Triumph variety is recommended.

Foot or stem blight of beans (*Macrophoma phaseoli*), first found in South Carolina two years ago, was abundant in the north-west of the State until its advance was arrested by dry weather.

Serious damage has been caused for two consecutive seasons by bacterial blight of garden peas [*Bacterium pisi*], which may affect the pods, leaves, or stems.

HASKELL (R. J.). **Diseases of cereal and forage crops in the United States in 1925.**—*Plant Disease Reporter, Supplement* 48, pp. 301–381, 1 map, 1926. [Mimeographed.]

This report has been prepared on similar lines to earlier ones of the same kind [see this *Review*, iv, p. 596].

Bunt of wheat (*Tilletia levis*) was unusually prevalent in the middle Atlantic States and in parts of Kansas and Colorado, the loss in the former State being estimated at $7,000,000 to $8,000,000. It has been shown that comparatively low temperatures favour the germination of *T. tritici* [ibid., ii, p. 13; iii, p. 512], and this factor probably operates also in the case of *T. levis*. Thus the heavy incidence of infection in 1925 may be readily explained by the abnormally low temperatures prevailing during the sowing period (middle of September to third week in October, 1924), in Pennsylvania and Virginia.

In connexion with the control of stem rust of wheat (*Puccinia graminis*) the barberry eradication campaign was carried out in 13 States, 149,822 bushes being destroyed on 4,119 properties.

Pink root (*Fusarium* sp.) of cereals was again reported from California, where it caused the death of wheat and barley plants at all stages from seedling to maturity, blasting the spikelets and shrivelling the kernels. The damage was estimated at 4 per cent. for wheat and 2 per cent. for barley. Oats are also stated to be affected.

A bacterial leaf blotch of oats, caused by *Pseudomonas* sp., was reported as very common on the Fulghum and Swedish Select varieties in Arkansas. The yellowish or brownish, irregular spots

are not surrounded by a halo as in the case of halo leaf blight (*Bacterium coronafaciens*).

Green smut (*Ustilaginoidea* sp.) was reported for the first time on maize from Louisiana. The fungus may be identical with that occurring on rice [*U. virens*], but cross-inoculations will be necessary to establish this point.

Speckled blotch of rice (*Septoria oryzae*), which is known to occur in Italy, Brazil, China, and Japan, was reported for the first time to the survey from Florida.

Stripe of sorghum (*Bacterium andropogoni*) was common, but caused little damage, in Kansas, Texas, and Minnesota. Bacterial blight of lucerne (*Bacterium medicaginis*) was reported from a number of States. In Utah the cool, wet season greatly intensified the severity of this disease, the losses from which in some fields amounted to 50 or 60 per cent. Leaf spots of lucerne (*Cercospora medicaginis* and *Ascochyta imperfecta*) were also reported, the former being less prevalent than usual owing to the dry season.

Powdery mildew of clover (*Erysiphe polygoni*) was again widespread, 1925 being the fifth consecutive year in which it has been prevalent on red clover. The appearance of this disease in the Pacific North-west for the first time in 1924 and its increase during 1925 tend to confirm the theory that a new physiologic form of the mildew has been introduced into the United States, where it is spreading from east to west.

Bacterial blight of soy-bean (*Bacterium glycineum*) [see this *Review*, v, p. 591] was reported from Indiana, Illinois, and a number of southern States. In Illinois it was probably the most serious disease of soy-bean. Bacterial pustule (*Bact. phaseoli sojense*) [ibid., iv, pp. 328, 329] was reported from Delaware and the Arlington Experiment Farm, Virginia. Considerable differences in varietal susceptibility were observed in the latter locality. Bacterial leaf-blight (*Bact. sojae*) [ibid., i, p. 147] was recorded in Louisiana.

A species of *Cercospora* caused a very severe spotting of soy-beans in Louisiana, the Laredo variety being chiefly affected. In some fields the plants were so badly attacked that they assumed a yellowish cast, the spots numbering one to two hundred on a single leaflet. *Septoria glycines* Hemmi [ibid., iv, p. 468] was reported on the same crop from Delaware, where it was more prevalent than in 1924.

PETRI (L.). **Lo stato attuale di alcune questioni concernenti le ruggini dei cereali.** [The present situation with regard to cereal rusts.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 184–200, 1926.

The author continues his discussion on the evolution of different cereal rusts [see this *Review*, v, p. 658]. In the present contribution, the experimental cultivation of rusts and their propagation from season to season are discussed. Literature dealing with the importance of the aecidial stage is briefly reviewed, but it is regarded as not yet certain if the absence of the aecidial host may interfere with prolonged propagation of the fungus. Even in the south of Italy *Berberis vulgaris* is of common occurrence in Calabria, and *B. aetnensis* is found in Calabria, Sardinia, and Sicily; the aecidial form of *Puccinia graminis* is frequent on the latter near Catania.

Reference is made to the slight damage caused by brown rust of wheat (*P. triticina*) in Italy, even in the south, as compared with *P. graminis* and *P. glumarum*. The genetic relationship between the species of *Aecidium* found on *Thalictrum* in Italy and *P. triticina* has not yet been determined; they have been variously referred to *P. borealis*, *P. persistens*, and *P. septentrionalis*. Similarly nothing is known as to the importance of the aecidial stages of the other cereal rusts in Italy.

Roussakov (L. F.). Из результатов по исследованию ржавчины хлебов в **1922–1924** г. [Some results of the survey of cereal rusts in 1922–1924.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 569–571, 1926.

The present paper, read by the author at the 5th All-Russian Congress of Entomology and Phytopathology in February, 1925, is a compendium of the conclusions arrived at by him as a result of a survey of cereal rusts in Russia during the period from 1922 to 1924. The salient points are that he considers the stubble remaining in the fields up to the time of sowing of the autumn cereals as the most dangerous source of infection. The rusts are present on stubble in their uredospore stage for over two months in the south but only for some days in the north, where the infection passes directly from the stubble on to the autumn-sown seedlings. The development of the rusts in the autumn is more dependent on temperature than on humidity: the higher the temperature in September and October the stronger is the development of the rusts. *Puccinia dispersa* and *P. triticina* are more resistant to lower temperatures than the other species. Both these rusts and also *P. glumarum* usually live over the winter on the autumn-sown cereals practically over the whole extent of European Russia, both as uredospores and as mycelium, while *P. graminis* [stated to be the most widespread species on autumn seedlings] disappears during the winter. The rusts overwinter best under a continuous cover of snow that has fallen on frozen soil, while in years of light snowfalls and frequent thaws the conditions are much less favourable for their persistence through the winter. As measures of control, the author recommends the destruction of wheat and rye stubble before the autumn sowings, which should be made somewhat later in the season in the centre and south of Russia, especially in the Ukraine. Early in the spring, autumn-sown cereals should be harrowed to destroy the older leaves bearing the rusts. An earlier sowing of the spring cereals would tend to diminish the incidence of the rusts in the spring.

Roussakov (L. F.). К вопросу об учете вреда от ржавчины хлебов. [A method for the evaluation of the damage caused by rusts to cereals.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 574–580, 1 chart, 1926.

A chart is given illustrating a method for the evaluation of the damage caused by rusts to cereals, in which the following factors are represented by curves: intensity of attack; withering of the leaves attacked; weight of 1,000 grains; nature of the grain; and yield of the harvest. The chart is based on observations [details of

which are given] on artificially induced outbreaks of *Puccinia graminis* and *P. coronifera* [*P. lolii*] on oats in experimental plots.

MAINS (E. B.), LEIGHTY (C. E.), & JOHNSTON (C. O.). **Inheritance of resistance to leaf rust, Puccinia triticina Erikss., in crosses of common Wheat, Triticum vulgare Vill.**—*Journ. Agric. Res.*, xxxii, 10, pp. 931–972, 5 pl., 1926.

This is a detailed account of experiments conducted since 1920 in the field at Washington, D.C.; Knoxville, Tenn.; La Fayette, Ind.; and in the experiment station greenhouses at La Fayette, Ind.; and Manhattan, Kans., with a view to studying the inheritance of resistance to leaf rust (*Puccinia triticina*) in crosses between resistant and susceptible varieties of common wheat.

In crosses with Kanred as the resistant parent and one or other of a number of susceptible varieties [a list of which is given] as the other parent, the F_1 generation was either as susceptible as the latter or to some degree intermediate. Intergrading degrees of susceptibility were found in the F_2 generation, but some segregates showed the resistance of Kanred. Many of these segregates produced susceptible plants in the F_3 generation, while others gave only resistant plants. Several lines obtained in the F_4 generation were apparently pure for resistance and possessed some of the desirable characters of the susceptible parent. It is suggested that the resistance of Kanred may be dependent on several factors.

A study of nine crosses with Malakoff as the resistant parent and various susceptible varieties as the other parent, tested with pure cultures of certain physiological forms of *P. triticina* [see this *Review*, v, p. 477] to which Malakoff is resistant, showed that the resistance of this variety to such physiological forms is dependent on a single dominant factor. As Malakoff is susceptible to certain other strains of *P. triticina*, a cross was made between it as the susceptible, and Webster C.I. 3780 as the resistant parent. A test in which this cross was inoculated with a strain to which Malakoff is susceptible, showed that resistance is apparently dependent upon a single main-factor difference, as a segregation of 1 resistant : 2 intermediate : 1 susceptible occurred.

A cross with a selection of Fulcaster as the resistant parent and Kanred as the other, tested with a strain of *P. triticina* to which the latter variety is susceptible, indicated that in this hybrid also resistance is apparently dependent on a single main-factor difference. The heterozygous plants in the F_2 generation became progressively more resistant in successive stages of the growth of the host plant, while homozygous-resistant and homozygous-susceptible plants maintained resistance and susceptibility, respectively, in all stages.

In the F_2 of a cross between Malakoff and C.I. 3778 studied for reaction to forms V and XII (Malakoff being resistant to form XII and susceptible to form V, and C.I. 3778 showing the reverse reaction) the resistance of Malakoff to form XII was dominant, while the resistance of C.I. 3778 to form V was recessive. The data indicate that the resistance of each parent is dependent on a single independently inherited factor. Similar results were obtained in a study of the inheritance of Norka and C.I. 3756 to forms V and XII.

Resistance to the various physiological forms of *P. triticina* is due therefore to different factors, or groups of factors inherited as a unit, the different factors or groups being independently inherited.

PETRI (L.). **Esperienze sull' azione preservativa dello zolfo e dello zolfo-ramato contro le ruggini del Grano.** [Experiments on the preventive action of sulphur and of cupric sulphur against wheat rusts.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, p. 236, 1926.

The results of three series of experiments in the use of sulphur and cupric sulphur [see this *Review*, i, p. 66] for the control of wheat rusts [*Puccinia* spp.] conducted on experimental plots at the Villa Umberto, Rome, and at Anagni, are given. The tests were carried out on various soils and with different varieties of wheat. Three dustings were given in two of the series and two in the other.

A beneficial effect as compared with the untreated plots was noticeable, more especially on the variety Gentil Rosso growing in deep moist soil dusted three times with cupric sulphur or sulphur in May.

BRIGGS (F. N.). **Inheritance of resistance to bunt, Tilletia tritici (Bjerk.) Winter, in Wheat.**—*Journ. Agric. Res.*, xxxii, 10, pp. 973–990, 5 graphs, 1926.

The experiments described in the present paper were carried out in the field at the University Farm, Davis, California, where conditions are stated to be especially suitable for the purpose of the investigations because relatively high bunt infections can be obtained in autumn-sown wheats. The scope of the work was to study the inheritance of resistance to bunt (*Tilletia tritici*) in F_1, F_2, and F_3 generations of crosses of (1) susceptible × susceptible, (2) resistant × resistant, and (3) resistant × susceptible varieties of common wheat. Martin and Hussar varieties were used as the resistant parents, as during the five years they were kept under observation they remained entirely free from bunt, while Hard Federation, Baart, and White Federation produced from 50 to 95 per cent. of diseased ears during the same period.

From a cross between Hard Federation and Baart, which differ slightly in their susceptibility to *T. tritici*, no plants were segregated which were more resistant or more susceptible than the parents. The difference in the susceptibility of the parents is probably due to modifying factors. In Martin crossed with Hard and White Federation, as indicated by the F_1, resistance was completely dominant, and in Hussar with Baart and Hard Federation it was almost dominant. Data obtained in the F_2 and F_3 generations indicate that Martin differs from Hard Federation and from White Federation by one dominant factor for resistance, and Hussar possibly differs from Hard Federation and from Baart in two dominant factors, of which one is identical with that in Martin.

The results obtained with Martin and Hussar indicate, in the author's opinion, that it should be a simple matter to use these two varieties in breeding for resistance to bunt.

BRENTZEL (W. E.). **Loose smut of Wheat.**—*North Dakota Agric. Exper. Stat. Circ.* 29, 11 pp., 6 figs., 1926.

Loose smut of wheat [*Ustilago tritici*] is stated to be increasing to a very alarming extent in North Dakota, where 3 to 25 per cent. infection is frequently observed on the Kota variety. No steps have been taken to control this disease, which now causes almost as much damage as bunt [*Tilletia levis*]. The life-history of the loose smut fungus is briefly described in popular terms, and directions are given for its control by the hot water treatment. The manipulation of a simple equipment for this mode of treatment is briefly explained. For treating larger quantities of seed-grain a steam apparatus may be used, and directions are also given for the application of this method, which involves the passage of live steam through the coils of a pipe situated near the bottom of the tank.

TIEMANN (A.). **Untersuchungen über die Empfänglichkeit des Sommerweizens für Ustilago tritici und den Einfluss der äusseren Bedingungen dieser Krankheit.** [Investigations on the susceptibility of summer Wheat to *Ustilago tritici* and the influence of the external conditions on this disease.]—*Kühn-Arch. Arb. Landw. Inst. Univ. Halle*, ix, 1925. [Abs. in *Fortschr. der Landw.*, i, 9, pp. 292–293, 1926.]

Different varieties of wheat were found to vary in their reaction to infection by loose smut (*Ustilago tritici*). In many cases smut sori were found on the upper leaves and on the main haulm. A certain proportion of the seeds infected by the mycelium yielded healthy plants. The Bordeaux variety was found to be very susceptible; Janetzko, Kinnay, and Findig less so; while Strube's Silesian and Wohltmann's Green and Hungarian Theiss were immune. The resting mycelium in the seed is viable for several years (at least three). Late sowing, especially at high temperatures, promotes infection. A medium depth of sowing (4 to 5 cm.) was found to act as a deterrent to the development of the fungus. Nitrogenous fertilizers, applied in moderate quantities, reduced the amount of loose smut. Careful selection of the seed-grain was effective in controlling the disease.

LOBIK (A. I.). **К методике определения загрязненности зерна спорами головни.** [A method for the determination of the degree of contamination of grain with smut spores.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 602–604, 1926.

A method is described in detail for the estimation of the degree of contamination of a sample of cereal grains with spores of Ustilaginaceae. One hundred grains, taken from a representative sample, are shaken with 10 c.c. of water in a test tube, and a drop of the spore suspension is removed with a pipette of a determined calibre and mounted on a glass slide, the number of spores being then determined under a low-power microscope. From this is calculated the average number of spores adhering to each grain.

The results of a large number of determinations showed the following correlations between the percentage of infection of the crop in the field and the number of spores per grain: 0·1 to 3·5 per

cent. infection—60 to 440 spores; 3 to 6 per cent.—820 to 1,070 spores; 7 to 10 per cent.—1,700 to 5,440 spores; 14 to 18 per cent. —7,228 to 10,715 spores; 20 to 50 per cent. and over—up to 160,000 spores. From these figures the conclusion is drawn that with seed carrying up to 500 spores per grain infection of the resulting crop should be but slight, from 500 to 2,500 spores, moderate, and above 2,500 spores per grain, heavy.

HAHNE (J.). **Untersuchungen über die Keimungsbedingungen von Tilletiasporen.** [Investigations on factors influencing the germination of *Tilletia* spores.]—*Kühn-Arch. Arb. Landw. Inst. Univ. Halle*, ix, 1925. [Abs. in *Fortschr. der Landw.*, i, 9, p. 292, 1926.]

The minimum, optimum, and maximum temperatures for the germination of *Tilletia* [*tritici* and *T. levis*] were determined as 4°, 18° to 20°, and 36° C. respectively. In arable soil these organisms cannot lead a saprophytic existence for any length of time, nor can their spores overwinter in an ungerminated condition. Organic acids cannot replace the stimulus of light, the exclusion of which retards germination. Even in the absence of light, however, nitrogenous salts promote germination. Salts of light metals failed to inhibit growth at a concentration of 0·1 per cent., and at weaker strengths they frequently acted as stimulants. Heavy metal salts (except manganese and zinc) exercised an inhibitory action even at 0·001 per cent., while salts of organic acids were still more injurious to germination. The germination of the spores in the field was promoted by fertilization with saltpetre and impeded by the use of ammonium sulphate, while calcium cyanamide proved directly toxic. Phosphates were found to retard spore germination and potassium salts to stimulate it. Heavily infected manure was found to be harmless to the crop after protracted keeping.

TISDALE (W. H.). **Copper carbonate prevents bunt (stinking smut) of Wheat.**—*U.S. Dept. of Agric. Circ.* 394, 9 pp., 6 figs., 1926.

In this bulletin the use of copper carbonate is definitely recommended for the prevention of wheat bunt (*Tilletia tritici* and *T. levis*), and of kernel smut of sorghum [*Sphacelotheca sorghi*]. It is not considered efficient for the control of the smuts of oats (*Ustilago avenae* and *U. levis*) and barley (*U. hordei* and *U. nuda*) or of the loose smut of wheat (*U. tritici*). A description is given of methods for treating the seed with the chemical, with a diagram of a simple type of barrel mixer.

HÜLSENBERG (H.). **Verbindungen des Kupfers als Beizmittel.** [Copper compounds as disinfectants.]—*Deutsche Landw. Presse*, liii, 24, p. 394, 1926.

The writer formulates the following requirements as essential to the success of a cereal seed disinfectant: (1) economy of application; (2) certainty of action; (3) absence of properties toxic to the seed-grain; (4) slight adsorptivity; (5) stimulatory qualities; and (6) universality of effect. Copper sulphate is eminently unsatisfactory, particularly with regard to points (4) and (5), and its

continued extensive use, in spite of its many disadvantages, is much to be deprecated. In the experiments carried out by the Phytopathological Experiment Station of the Agricultural Chamber for Saxony, even five minutes' immersion in a 1 per cent. concentration proved injurious to wheat seed-grain. Notwithstanding its apparently low price (70 Pf. per kg.), copper sulphate is considered to be actually dearer than uspulun or germisan at Mk. 11 per kg., owing to its deleterious effect on the seed.

In the writer's opinion, the future of seed-grain disinfection lies exclusively in dusting, though germisan (the excellence of which is indisputable) will probably maintain its present popularity for some time to come. Segetan I and II (now replaced by segetan-neu) consist of ammoniacal copper salts of organic and inorganic acids with mercury or silver cyanide. Tillantin B and C consist of copper-arsenical compounds, C also containing mercury. Segetan-neu is officially recommended for the control of bunt [*Tilletia tritici* and *T. levis*] and *Fusarium* [of rye: *Calonectria graminicola*]; tillantin B against bunt; and tillantin C against bunt, stripe disease of barley [*Helminthosporium gramineum*], and loose smut of oats [*Ustilago avenae*]. Höchst dust, tentatively recommended for the control of bunt, is stated to be similar in composition to tillantin.

Neither copper carbonate, as used in the United States, nor porzol [see this *Review*, v, p. 172] has been found suitable for German requirements. Abavit, consisting of copper carbonate with the admixture of small quantities of copper sulphate and an arsenic compound, has proved useful in the disinfection of rye and wheat, while abavit B, a mercurial preparation, is satisfactory for the treatment of oats and barley.

HOLLRUNG (N.). **Das Kupfer als Beizmittel gegen den Steinbrand.** [Copper as a disinfectant against bunt.]—*Kühn-Arch. Arb. Landw. Inst. Univ. Halle*, ix, 1925. [Abs. in *Fortschr. der Landw.*, i, 9, p. 292, 1926.]

Of ten copper compounds examined at Halle for fungicidal efficacy and for their effect on the germination of treated wheat seed-grain, a 0·1 per cent. solution of ammonial copper sulphate (30 minutes' immersion) was most satisfactory for the control of bunt [*Tilletia tritici* and *T. levis*]. Certain copper salts failed to destroy spores treated for 30 minutes at 0·1 per cent., merely inhibiting germination, which was resumed when the spores were sown in a manure decoction. Acid media prevented the germination of the spores.

MENCACCI (M.). **Esperienze per determinare l'azione di alcuni trattamenti al grano.** [Experiments to determine the action of certain treatments on cereal seed.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 216–235, 2 pl., 1926.

The author carried out a series of tests to ascertain the effect on germination and the fungicidal value of uspulun, germisan, and some other compounds when used with cereal seed-grain. The results are presented in tabular form and fully discussed in the text.

Uspulun, either in solution as the soluble chlorophenolmercury form or dry as the insoluble nitrophenolmercury form, did not appear to give any stimulus to germinative energy or subsequent

development in laboratory tests. On the contrary, germination was slightly retarded, and the appearance of the seedlings was distinctly inferior to that in the control. Comparative tests with uspulun in solution and as powder led to the conclusion that it is preferable to use the dry form. The results of further experiments to determine the effect of uspulun on the germination and subsequent growth of wheat and oats carried out in the field did not correspond completely with those obtained in the laboratory tests. No deleterious effect was evident from the treatment, a fact which is attributed to the less direct contact between uspulun and seed coat in the soil than on sand or blotting-paper. In the case of oats there was even an evident beneficial effect on development, especially marked after treatment with soluble uspulun (0·25 per cent. for 30 minutes). The value of this preparation in the control of bunt of wheat [*Tilletia tritici* and *T. levis*] was clearly shown. Immersion for one hour in a 0·15 per cent. solution reduced the percentage of infection from 60·68 to 6·97. Dry uspulun (3 parts by weight per thousand) reduced infection to 5·39 per cent. Disinfection with copper sulphate and germisan appeared to be still more effective. Bunt was completely eliminated in both cases and the appearance of the plants was very satisfactory, but the weight of the grain was lowered by treatment with germisan. A stand free from infection was produced with copper sulphate, but its use is attended with risk of injury to the grain.

Notes are also given on tests with some newly manufactured Italian cereal seed stimulants.

PETRI (L.). **Concentrazione degli ioni di H e azione del calore sulle germinabilità delle spore di Ustilago tritici.** [Hydrogen-ion concentration and the action of heat on the germinability of spores of *Ustilago tritici*.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 251–252, 1926.

The results of earlier experiments (*Boll. R. Staz. Pat. Veg.*, vi, 2, p. 161) showed that wheat seed-grain can be exposed to a temperature superior to that generally used in the Jensen method of smut control when the water is acidified (P_H 4) without any appreciable damage to germinability, whilst a neutral reaction renders the seed unusually sensitive to the action of heat. A slightly alkaline reaction (P_H 9·5 to 10) increased the resistance of the grain but not to the same extent as acidification. Recent tests with spores of *Ustilago tritici* showed that a similar acidification did not increase their resistance to heat, no germination being obtained when the spores were immersed in water at P_H 4 for three hours at room temperature and then for 15 minutes at 50° to 52° C. Further tests will be carried out with wheat grain containing the internal mycelium of the fungus.

RIVERA (V.). **Carie del Frumento e raggi X.** [Bunt of Wheat and X-rays.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 237–241, 1926.

After briefly commenting on the successful results obtained by Pichler and Wöber in the use of X-rays for the control of certain cereal smuts [see this *Review*, ii, p. 324], the author describes

similar experiments carried out by him on wheat heavily contaminated by bunt (*Tilletia*) [*T. tritici* and *T. levis*].

Two series of tests were made at an interval of one month, using dry seed-grain in both cases. In the first test, seed was exposed to the rays for 7 to 20 minutes at a distance of 40 cm. In the second, radiation was prolonged for 25 to 105 minutes, the distance being varied from 28 to 40 cm. The effect of the rays on the seed and on the bunt spores was determined and also the percentage of infected ears from the treated and non-treated seed.

Germination of the seed was only very slightly affected by radiation, while that of the spores was not reduced at all, nor had the treatment any effect in diminishing the number of infected ears. The discrepancy between these results and those of Pichler and Wöber will be further tested with more prolonged radiation and decreased focal distance.

BERTOLI (E.). **Una nuova malattia del Frumento?** [A new disease of Wheat?]—*Il Coltivatore*, lxxii, 20, pp. 50–53, 1926.

A brief account is given of an obscure disease of wheat which decimated a number of fields in northern Italy in 1925–6, frequently necessitating the ploughing up of the crop and replanting with maize. Affected plants showed, in April or May, a yellow (later reddish-brown) discoloration of the upper part of the leaves, followed by rapid and complete drying up of the plants. The disease occurred in a highly irregular fashion, sometimes attacking isolated plants, sometimes spreading from one plant to another in wide circles. A number of theories have been advanced to explain the phenomenon, including the exceptionally low winter and spring temperatures, infection by insect or fungous parasites, and the like. The roots of older affected plants were dark yellow, and in the later stages the collar and base of the stem were covered with a white mycelium. The production of adventitious roots and root hairs was a characteristic feature of the early stages of the disease.

CAMPANINI (L.). **Un nuovo parassita del Frumento?** [A new parasite of Wheat?]—*Il Coltivatore*, lxxii, 23, pp. 146–148, 1926.

The obscure disease of wheat which has caused so much damage in northern Italy [see preceding abstract] is attributed by the writer primarily to the effect of the protracted and intense winter and spring cold on the plant tissues. The disorganization of the latter doubtless rendered them susceptible to the attacks of *Septoria graminum* and other fungous and insect parasites. The Ardito variety is stated to have been most severely affected. Marked benefit was derived from the use of phosphatic fertilizers.

PEYRONEL (B.). **Osservazioni sul 'mal del piede' dei cereali e sulle varie crittogame che lo producono in Italia.** [Observations on foot rot of cereals and on its various causal fungi in Italy.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 213–216, 1926.

Weather conditions in 1926 in Italy proved favourable to the development of foot rot of cereals [see this *Review*, v, p. 662], and the disease was possibly also more severe than usual owing to the

effect of the campaign for the extension of cereal cultivation in leading to the sowing of cereals in unsuitable or badly prepared land.

The disease is as frequently caused in Italy by *Leptosphaeria herpotrichoides* as by *Ophiobolus graminis*. Perhaps equally frequent were several species of *Fusarium* (*F. culmorum*, *F. monilioides*, *F. poae*, *F. graminearum* [*Gibberella saubinetii*], and an undetermined species) associated with foot rot, especially on rye from the Waldenses Valley, Piedmont. More rarely, a *Rhizoctonia* and sometimes a Hymenomycetous fungus were found associated with the disease, although the latter appeared to be a very weak parasite. All these fungi often occurred together on the same plant, the predominating species varying according to circumstances.

The same fungi are frequently found on weeds. On cereals their distribution is variable; certain fields seem practically immune, but the actual conditions predisposing to attack still remain obscure. Low temperature, excess of soil moisture, reduced vitality owing to attacks of other fungi on the leaves and upper part of the culm, and insufficient light, all appear to favour the disease. This last factor is considered to be especially important.

JONES (S. G.). **The development of the perithecium of Ophiobolus graminis Sacc.**—*Ann. of Botany*, xl, 159, pp. 608–629, 2 pl., 8 figs., 1926.

In a cytological study of the development of the perithecium in *Ophiobolus graminis* on oats, on which it has recently been observed in Wales, producing sterility and a bleached appearance, the author detected the hyphae (composed of uninucleate cells) in the cortical and vascular tissues. Spermogonia containing dense masses of very minute spermatia develop in the ruptured epidermis. They are believed to be functionless male organs. The perithecia appear singly or in groups of two or three as ovoid bodies with a long, smooth, curved beak. Fertilization is believed to be reduced to the conjugation of two or more vegetative cells, the ascogenous hyphae arising from such cells. The only nuclear fusion observed occurs in the young ascus. The ascospores are liberated by the dissolution of the ascus wall, and the spore bundles are extruded in a mass.

From its morphological and cytological characters the genus *Ophiobolus* is thought to belong to the Gnomoniaceae rather than to the Pleosporaceae.

HILTNER (E.). **Störungen gesunden Pflanzenwachstums durch unausgeglichene Ernährung, unter besonderer Berücksichtigung der Dörrfleckenkrankheit des Hafers.** [Disturbances of healthy plant growth through unbalanced nutrition, with special reference to the grey speck disease of Oats.]—*Fortschr. der Landw.*, i, 11, pp. 329–337, 16 figs., 1926.

The writer's investigations on the etiology and control of grey speck disease of oats are summarized and the principles underlying the 'carbonic acid-mineral substance law' recapitulated [see this *Review*, iv, p. 275, and next abstract]. Details are given of a number of recent experiments with lupins, fuchsias, fodder grasses, mustard [*Brassica alba*], and oats, in which pathological phenomena,

arising from the excessive use of mineral fertilizers, were counteracted by the addition of carbon in various forms. Tests with alder [*Alnus glutinosa*] and soy-bean [*Glycine hispida*] plants showed that inoculation with nodule bacteria affords a certain protection against the consequences of unbalanced nutrition.

HILTNER (E.). **Hafer-Dörrfleckenkrankheit und Hederichbekämpfung.** [Grey speck disease of Oats and control of Charlock.] —*Illus. Landw. Zeit.*, xlvi, 15, pp. 188–190, 3 figs., 1926.

Of recent years the writer has obtained excellent results in the combined amelioration of grey speck of oats [see this *Review*, iv, p. 275] and destruction of charlock [*Brassica sinapistrum*] and *Sinapis* [*Brassica*] *alba* by spraying with a solution of 20 per cent. copper sulphate and 5 per cent. manganous chloride, applied at the rate of 600 l. per hect. Manganous nitrate has also proved effective, but is stated to be too dear for general use.

JACZEWSKI (A. A.). Новый головневый грибок на Ржи. [A new smut fungus on Rye.]—*Изв. Гос. Инст. Опытн. Агр.* [*Annals State Inst. of Experimental Agronomy*], iii, 2–4, pp. 106–109, 1925. [Abs. in *La Défense des Plantes*, Leningrad, iii, 2–3, pp. 325–326, 1926.]

The present paper gives a description of a hitherto unrecorded smut, *Ustilago vavilovi* Jacz., attacking rye [see also this *Review*, v, p. 174]. The fungus was first discovered in Persia in 1916, and in 1924 was collected in the vicinity of Tashkent, Turkestan, by Vaviloff; there is also some evidence of its having been found in the western portion of the district of Verny in the Semiretchensk Territory. Morphologically this smut differs from specimens of *U. tritici* examined by the author on rye from the United States. Artificial infection experiments made in the spring of 1926 with *U. vavilovi* on spring-sown rye failed to give positive results, but it is pointed out that conditions in this year were very unfavourable for infection.

An ear of rye sent for examination from the Primorskaya region [Amur region, Siberia] was found to be attacked by *U. jensenii* [*U. hordei*], indistinguishable from the form attacking barley. Besides *Tilletia secalis* and *Urocystis occulta*, rye is therefore attacked by three other smuts, *Ustilago vavilovi*, *U. tritici*, and *U. hordei*.

SERBINOV (I. L.). К современному положению вопроса о „ пеллагре " в связи с учением о „ Кукурузной бели ". [On the present state of the question of 'pellagra' in relation to the theory of Maize 'white mould'.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 546–556, 6 figs., 1926.

The present paper embodies the results of the author's research work since 1915 on the white mould of maize, which is stated to be very widespread in Bessarabia [see also this *Review*, iv, p. 397] and to occur also in some localities of south Russia. In all the samples of diseased maize ears and maize flour submitted to him, the author constantly found, besides *Oospora verticillioides* [a detailed morphological and cultural description of which is given], the presence

of a polymorphic bacterium closely resembling in its morphological and biological characters *Bacterium lactis aceti*, from which it differs, however, in its capacity of growing at a temperature of 12° to 15° C., the optimum for its development lying between 36° and 39°. The organism, which is Gram-positive and a facultative aerobe, has been named *Micrococcus zeae* n. sp. It is very resistant to desiccation, retaining its viability for several years when dried on blotting-paper, glass slides, or in maize flour. According to the author's observations, this bacterium is carried by the insect *Opatrum intermedium*, which was found both on affected maize ears and in maize flour.

While *M. zeae* was present in practically every case of this maize disease investigated, in a fairly large number of cases *O. verticillioides* was absent, which fact, together with data collected from the literature on bacterial diseases of maize [briefly reviewed], leads the author to believe that the disease is primarily caused by *M. zeae*, the semi-parasitic *O. verticillioides* being only a secondary organism.

To test the toxic properties generally ascribed to maize affected with white mould, diseased grains and flour were fed to guinea-pigs. These experiments invariably resulted in the death of the animals in five to seven days under symptoms of a typical coli-typhoid infection. The author also believes these symptoms to be primarily due to *M. zeae* and not to *O. verticillioides*.

In regard to the control of the disease in the field, the author recommends steeping maize seed in 4 per cent. formaldehyde; using local maize varieties, stated to be resistant to the disease; and the destruction of insect vectors.

NISIKADO (Y.) & MIYAKE (C.). **Studies on the Helminthosporium-diseases of Maize.**—*Agric. Studies*, viii, 56 pp., 2 pl., 1926. [Japanese: Abs. in *Japanese Journ. of Botany*, iii, 2, p. (35), 1926.]

The authors' investigations and inquiries on maize blight (*Helminthosporium turcicum*) and spot disease (*H. maydis* Nisikado & Miyake) have shown that the former is widely distributed throughout the world, while the latter occurs only over a limited area. The chief differences between the two causal organisms in respect of the form and size of the lesions on the hosts, as well as of the conidia, are pointed out. *H. maydis* was found to be more sensitive than *H. turcicum* to the influence of temperature, the former making much more rapid growth at 30° than at 23° C., while there was no perceptible difference in the development of the latter at either temperature. At 20° to 30° the conidia of *H. turcicum* produce germ-tubes which soon form an appressorium at the tip: the appressorium in its turn develops a slender hypha which penetrates the host tissue. The germination of *H. maydis* is similar to that of *H. turcicum*, but the germ-tube is more slender and grows more rapidly. Inoculation experiments with the two fungi gave 56 per cent. positive results with *H. turcicum* and 100 per cent. with *H. maydis*. Both organisms developed between P_H 2·0 to 2·6 and 10·9, the best growth being made at P_H 4·9 to 9·1.

HURD-KARRER (ANNIE M.). **Effect of smut on sap concentration in infected Corn stalks.**—*Amer. Journ. of Botany*, xiii, 5, pp. 286–290, 1926.

Comparative determinations have been made of the specific gravity of the expressed juice of normal maize plants and of others infected with smut (*Ustilago zeae*). The work was directed primarily to determine whether the infected plant is able to replace substances removed by the growing gall, or whether the sap remains permanently impoverished.

The tabulated results indicate that the specific gravity of the juice expressed from infected stalks is lowered as compared with the corresponding internodes of healthy plants. This lowering of the sap concentration, although most pronounced at the internodes adjoining the smut gall, is often evident throughout the stalk. It may be so marked that the concentration gradient is reversed in that section of the stalk in the immediate vicinity of actively growing galls.

REICHERT (I.). **The smut diseases of Sorghum in Palestine.**—*Zionist Organ. Agric. Exper. Stat. & Colon. Dept., Div. of Exten., Leaflet* 11, 10 pp., 7 figs. [1926. Hebrew with English summary.]

A detailed description is given of two fungous diseases of sorghum which cause considerable damage in Palestine, namely, kernel smut (*Sphacelotheca sorghi*) and head smut (*Sorosporium reilianum*), the former occurring chiefly in upper Galilee and the latter in Samaria.

Instructions are given for the control of these diseases by crop rotation, cultural measures, and (in the case of kernel smut) seed disinfection by one hour's immersion in 0·5 per cent. uspulun or germisan, both of which reduced the incidence of infection from 27·5 per cent. to nil, while increasing germination from 40 to 85 per cent. Ten minutes' immersion in 1 per cent. copper sulphate, 15 minutes in 0·1 per cent. formalin, and 30 minutes in 0·15 per cent. corrosive sublimate also gave good control (0, 0, and 2·4 per cent. infection, respectively), but the first-named preparation reduced germination to 25 per cent. and the others failed to stimulate it.

FAWCETT (H. S.) & LEE (H. A.). **Citrus diseases and their control.** – xii + 582 pp., 15 col. pl., 190 figs., New York & London, McGraw-Hill Book Co., 1926.

This book gives a comprehensive account of the fungous, bacterial, and non-parasitic diseases of citrus trees which occur in the United States, the Mediterranean Region, Australia, South Africa, the West Indies, and the East. It has been prepared to meet the needs mainly of the growers in California and Florida, and the diseases present in those States are given special attention. The numerous figures in black and white are for the most part photographs of the salient characters of the diseases, while there are a number of plates in colour which are very true to nature in showing the effects of some 25 of the principal diseases.

In the general part there are chapters on the species and varieties of citrus grown, the geographical distribution and ecology of the diseases, general principles of control, fungicides, disinfectants, and cultural operations.

In the special part, the individual diseases are grouped into those attacking (*a*) roots and trunks, (*b*) branches, twigs, and leaves. and (*c*) fruits. Each division is provided with a practical key to facilitate identification. There is an extensive and up-to-date bibliography which will be welcome to pathologists, but no attempt has been made to list the fungi which have been recorded on citrus.

The work will be essential to all those who are concerned with the diseases of citrus plants in various parts of the world.

PETRI (L.). **Ulteriori osservazioni sul disseccamento dei Limoni in provincia di Messina.** [Further observations on wither-tip of Lemons in the Province of Messina.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 209–212, 1 fig., 1926.

In further observations on the wither-tip of lemons due to *Colletotrichum gloeosporioides* in the Messina district of Sicily [see this *Review*, v, p. 665] the author records two interesting facts. In very many cases the mycelium of the fungus occurs in the woody tissues of a branch without causing death for some considerable time and without producing any fructifications on the bark until after the death of the branch. The vessels of the xylem and protoxylem are penetrated through leaf scars or broken spines. As a result of this invasion the leaves turn yellow and fall, while later on, the twigs also become yellowish in the infected region. Infected vessels are filled with gum and can be recognized by this condition. In some cases, however, a leaf fall has been observed on branches in which no trace of mycelium could be detected. This occurred only in mature plants already infected by *C. gloeosporioides* in some other part of the crown, and may be considered to be an indirect result of a toxic action exercised by the parasite.

The second observation was the high degree of resistance to the disease shown by the stems of young lemon plants budded on bitter orange [*Citrus bigaradia*]. When infected, such stems were never seriously attacked, though the young shoots on them were somewhat highly susceptible.

NOWELL (W.). **Diseases of Coffee.**—*Proc. Agric. Soc. Trinidad and Tobago*, xxvi, 7, pp. 339–342, 1926.

In this account of an address by the author on coffee diseases in Trinidad, there is a brief description of the root diseases caused by *Rosellinia* spp.; thread blights [see this *Review*, iv, p. 66], of which two are known in the island, one, which is commonest on cocoa, causing a tree-like pattern on the leaf, while the other forms a thin film; and viruela or the American leaf disease [*Omphalia flavida*: ibid., v, p. 160]. The last-named disease is restricted to certain localities, and apparently a considerable time elapses before the damage, which is cumulative, becomes noticeable on the diseased plants; its dissemination is also a slow process and is thought to be

in part effected by the passage of labourers, carrying the fungus on their clothing, from one part of an estate to another. The leaf disease may be controlled by cutting down infected trees to 12 inches from soil level, and burning all diseased leaves and weeds in the vicinity.

Cercospora leaf spot [*C. coffeicola*: ibid., ii, p. 408] is general throughout the Colony and may be adequately controlled by attention to shade and soil conditions.

Sclerotium disease [*S. coffeicolum*: ibid., i, p. 14], which has existed in Surinam for many years, has been recently found in Trinidad. It is at present limited to only a few bushes of the Excelsa variety, a member of the Liberian group to which the disease has so far been confined. The fungus causes large concentric markings on the leaves and also attacks the berries. Its restricted incidence permitted of control by the removal and destruction of diseased material.

LUDWIG (C. A.). **Studies with anthracnose infection in Cotton seed.**—*South Carolina Agric. Exper. Stat. Bull.* 222, 52 pp., 5 figs, 9 graphs, 1925. [Received September, 1926.]

Cotton seed infected by the anthracnose fungus, *Glomerella gossypii* [see this *Review*, v, p. 90], is stated to become free of infection during storage. Under laboratory conditions this action proceeds very slowly until the seed is about a year old, after which the organism rapidly loses its virulence. By the second spring after harvest the seed has practically become safe for sowing.

In a series of experiments carried out in South Carolina from 1921 to 1924 on heavily infected cotton seed, the only promising method of seed treatment preliminary to storage was delinting with strong sulphuric acid and sterilizing with mercuric chloride. The initial infection of seed thus treated is reduced to a minimum, and that remaining within the seed appears to be eliminated some months earlier than in untreated material. Probably delinting alone would suffice for this purpose.

The storage of seed in a very moist atmosphere produced the most rapid reduction in anthracnose infection of any of the methods tested, but the seed soon became musty and failed to germinate. Of the other methods of ordinary storage tried in these experiments, location over a radiator seemed to be the most effective in the getting rid of the fungus, and outdoor storage under a shelter least so. The results of storage in the open laboratory and in an incubator with a temperature fluctuating round 30° C. were intermediate. Storage in a very dry atmosphere, e. g., in a desiccator over calcium chloride, was found to prolong the life of the fungus to a great extent, whatever the preceding treatment of the seed. The exposure of the seed to alternate very dry and very moist conditions at first seemed to induce a more rapid decrease of infection than is secured by ordinary laboratory storage, and there was little damage from mustiness: complete freedom from infection, however, was attained little or no sooner. Sunning the seed appeared to accelerate the death of the fungus to some extent, but germination was seriously impaired before results of practical value were obtained.

MONTPELLIER (J.) & CATANEI (A.). **Présence du même Monilia chez deux malades porteurs de lésions différentes de la cavité buccale.** [Presence of the same *Monilia* in two patients suffering from different affections of the buccal cavity.]—*Comptes rendus Soc. de Biol.*, xcv, 26, pp. 568–569, 1926.

Two cases of infection of the buccal cavity with different symptoms but both associated with the same species of *Monilia* [*Candida*] are reported from Algiers. The first was a typical case of thrush in a native infant, and the second one of streptococcal glossitis in a five-year-old native girl. The clinical symptoms of both disturbances are briefly described.

The fungus isolated from the affected tissues developed round or oval cells, measuring 3·5 to 6 μ and forming a thin membrane on solid media, and short chains with lateral buds or small clusters on liquid ones. Hyphae of the *Monilia* type were observed in gelatine subcultures. The fungus made good growth at 37° C. Gelatine was not liquefied nor serum coagulated; glucose, maltose, levulose, and dextrin were fermented with production of gas. The organism differs in morphological characters from *M.* [*Candida*] *albicans* and its biochemical reactions also indicate its occupation of a separate position in the group.

STREMPEL (R.). **Mykosen der Hände und Füsse.** [Mycoses of the hands and feet.]—*Klin. Wochenschr.*, v, 30, pp. 1374–1377, 1926.

Clinical details are given regarding the etiology, symptoms, and cure of various pathological conditions of the hands and feet associated with the presence of certain Dermatomycetes, including species of *Trichophyton* belonging to the *gypseum* and *niveum* groups, and *Oidium* [? *Oospora*] spp. A bibliography of some forty titles is appended.

BROCQ-ROUSSEU, URBAIN (A.), & BAROTTE (J.). **Anticorps dans les teignes expérimentales.** [Antibodies in experimental ringworm.]—*Comptes rendus Soc. de Biol.*, xcv, 25, pp. 464–466, 1926.

The serum of guinea-pigs inoculated with *Trichophyton equinum* or *T. gypseum* [see this *Review*, v, p. 555] was found to contain antibodies, sometimes in very large quantity, which gave a specific 'fixation reaction' in 85 per cent. of the cases. The inoculation of trichophytine (the filtrate of cultures) into guinea-pigs infected by ringworm considerably increased the quantity of antibodies in the serum in six to eight days.

EBERBECK (E.). **Aetiologisch-biologische und pathologisch-histologische Untersuchungen über die Lymphangitis epizootica des Pferdes.** [Etiological-biological and pathological-histological investigations on epizootic lymphangitis of the horse.]—*Arch. wissenschaftl. u. prakt. Tierheilkunde*, liv, 1, pp. 1–31, 8 figs. (3 col.), 1926.

Loeffler's blood-serum medium prepared from horse serum proved satisfactory for the further cultivation of two strains of the causal organism of epizootic lymphangitis [generally known as *Crypto-*

coccus farcinimosus: see this *Review*, v, p. 554] maintained on glycerine-dextrose-agar at 22° C. for about six years. Growth was made only at room temperature, none occurring at 37°.

The development of free asci containing four typical spores leads the author to place the fungus in the genus *Endomyces* as *E. farcinimosus*. The virulence of the strains, which had been almost entirely lost on the sugar-agar medium, was recovered when the cultures were grown on horse serum.

It was found impossible to infect a horse by friction with a virulent culture on a shaved area of skin. Subcutaneous inoculation produces an abscess, but the organism seems to disappear in great part from the inoculated area within 24 hours.

The symptoms of infection are described and some histological data given.

ZYBINA (Mme S. P.). **Отчет по обследованию Льняных болезней Волоколамского Опытного Поля Московской губернии летом 1924 г.** [Report on the survey in the summer of 1924 of the Flax diseases in the district of the Volokolamsky Experiment Field in the government of Moscow.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 581–587, 1926.

Owing to the growing interest displayed of recent years in the intensification and amelioration of flax culture in Russia, the author was deputed in the summer of 1924 to make a survey of the diseases attacking the crop in the Volokolamsky district (government of Moscow), stated to be one of the most advanced in Russia from the point of view of agricultural progress. The three outstanding flax diseases recorded in the region were rust (*Melampsora lini*), wilt (*Fusarium lini*), and a spotting and consequent brittleness of the stem believed to be caused by *Polyspora lini*. The incidence and severity of the three diseases in the different localities of the district are discussed. Summarizing her observations, the author states that *M. lini* chiefly attacks the late varieties of flax, the early varieties apparently escaping infection; varietal and even individual variations in the susceptibility of flax to the rust were noted. *F. lini* was most severe on farms practising a three-year or shorter crop rotation, the incidence and virulence of the fungus decreasing with each additional year, until under a seven-year rotation the disease was practically non-existent.

HEYES (T. F.) & HOLDEN (H. S.). **The action of micro-organisms on silk.**—*Journ. Soc. Chem. Ind.*, xlv, 31, pp. 262T–265T, 1926.

A series of experiments was carried out at the bacteriological department of University College, Nottingham, to determine (*a*) whether bacteria and moulds would grow on silk; and (*b*) if so, whether such growth caused tendering, discoloration of the fabric, or alteration of its dyeing properties [see also this *Review*, iv, p. 280].

Eighteen species of *Aspergillus* grew fairly readily on dyed silk, but produced no structural damage or alteration in the dye except

that incidental to the presence of coloured spores. *A. carbonarius*, *A. candidus*, and *A. pulverulentus* also grew well on raw silk fibre, the two latter causing vivid yellow discoloration. *Rhizopus japonicus*, *Mucor racemosus*, *Penicillium expansum*, and *P. chrysogenum* all made prolific growth on the gum obtained from spun silk.

DOWSON (W. J.). **Botrytis and Narcissus.**—*Gard. Chron.*, lxxx, 2065, pp. 68–69, 2 figs., 1926.

This is a fuller account of the sclerotial disease of imported narcissus bulbs first observed in England in 1924 [see this *Review*, iii, p. 581]. In 1925 and again in 1926 black sclerotia embedded in the inner scales were more than once found in imported bulbs, and fructifications of the *Botrytis* type were developed from them under favourable moisture conditions. So far there is no record of bulbs growing in England having become infected from the imported ones.

The fungus agrees with that recorded by Klebahn on narcissus bulbs in northern Germany under the name of *B. narcissicola*. The same disease, referred to as 'smeul' (smoulder), is reported by Miss Westerdijk in Holland. Infection experiments with plants in pots grown under glass failed to reproduce the bulb symptoms, but the foliage and flower stalks were rapidly destroyed when infected through wounds. When kept sufficiently moist, the characteristic sclerotia appeared on the infected parts, though not found below soil level. Inoculations into other bulbous plants showed that tulips and irises were not susceptible, but the flowering stems and fruits of snowdrops were destroyed by the fungus in two consecutive seasons. The bulbs in this case also remained unattacked.

A second disease of narcissus, called locally the 'fire' disease, has recently been under observation by the author, and is considered to be caused by a hitherto undescribed species of *Botrytis* and to be distinct from the so-called 'fire' disease of narcissi reported in Europe as due to *B. cinerea*. It is proposed to name this species *B. polyblastis*, in reference to the unusually large number of germ-tubes to which the spores give rise. Affected leaves show large, elongated, yellowish-brown spots with a grey centre on which conidiophores are borne. Inoculation experiments gave positive results, infection taking place through both unwounded and wounded leaves. So far there is no evidence that the bulbs are attacked by mycelium passing down from the leaves. Elliptical sclerotia, $\frac{1}{4}$ by $\frac{3}{16}$ inch in diameter, are formed after the death of the foliage. The spores (some of which are up to 50 μ in diameter) are globular or slightly pear-shaped, papillate, and generally about eight spores are inserted on the slightly swollen head of the conidiophore by long sterigmata. The conidiophores measure approximately $\frac{1}{32}$ inch [about 800 μ] long, and are stout, slightly curved, and mostly unbranched. After detachment of the spores, delicate hyphae may be produced from the sterigmata under moist conditions. The conidiophores are not numerous, and after the first crop no others develop on the same spots, nor have they yet been formed in pure cultures. As many as 12 germ-tubes may be produced from a single spore when sown in water.

SIBILIA (C.). **Gloeosporiosi del Cyclamen persicum in Italia.** [Gloeosporiosis of *Cyclamen persicum* in Italy.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 241–250, 6 figs., 1926.

This disease of *Cyclamen persicum*, which sometimes causes considerable damage in Italy, appears to correspond closely to that described by Müller-Thurgau in Switzerland in 1922 [see this *Review*, ii, p. 269]. Isolations showed the presence in the diseased tissues of a *Gloeosporium* with at first hyaline and then olive-brown septate, densely massed conidiophores, measuring 30 to 35 μ in length, and hyaline to olive-brown, oval conidia, measuring on an average 13 by 5 μ. Both in its symptoms and in the morphology of the fungus no differences could be detected between the Swiss record and that of the author. Successful inoculations were carried out on young unwounded leaves; older leaves were difficult to infect. Since the fungus differs both morphologically and in cultural characters [details of which are given] from any species of this genus previously recorded, it is described as a new species under the name of *Gloeosporium cyclaminis*. A Latin diagnosis is given.

SERBINOV (I. L.). К вопросу о бактериальных заболеваниях злаков. Бактериоз ,,Суданской травы'', его этиология и меры борьбы с ним. [Contribution to the study of the bacterial diseases of Gramineae. Bacteriosis of 'Sudan grass', its etiology, and measures for its control.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 530–537, 1926.

Sudan grass, *Andropogon sorghum* [var. *sudanensis*], recently introduced in south Russia by seed from America, was observed by the author, in the very first year of its cultivation in the neighbourhood of Odessa, to be severely attacked by a bacterial disease which caused a spotting of the leaves. The spots were rounded or oblong and dark brown with a purple margin, or very occasionally entirely purple. The seed produced by the infected plants bore light brown or whitish spots. In germination tests their germinability was found to be slightly impaired, and a fairly high percentage of the seedlings raised from such seed developed a root and collar rot which rapidly killed them. The causal organism was isolated in pure culture and identified by the author as *Bacillus sorghi* (Burrill) Serb. (Principal bacterial diseases of Gramineae. *Rousky Melnik*, 6–7, pp. 203–206, 1916). It is further stated that the disease passed from the Sudan grass to maize and to common sorghum in the vicinity, the symptoms on these hosts being the same as those described above. The only means of control recommended is disinfection of the seed with formalin.

FRASER (W. P.) & SCOTT (G. A.). **Smut of Western Rye Grass.**—*Phytopath.*, xvi, 7, pp. 473–477, 2 figs., 1926.

Western rye grass (*Agropyron tenerum*), extensively used for hay in the prairie provinces of Canada, is stated to be heavily attacked in those provinces by a smut which considerably reduces its value for feeding purposes and seriously interferes with the production of seed. The smut attacks the spikelets, destroying the ovaries and usually the bases of the glumes, although frequently

the outer glumes are not affected. The sori are large, irregular, rather firm at first, but finally dusty. The spore mass is dark brown to black in colour. The causal organism, a morphological description of which is given, closely resembles *Ustilago bromivora* and is assigned to this species. Seed inoculation experiments showed that it can also attack *A. richardsoni* and *A. dasystachyum*. It was established that the disease may be controlled by the formaldehyde solution as used for cereals.

MONTEITH (J.). **Control of turf diseases with chemicals.**—*Bull. U.S. Golf Assoc., Green Sect.*, v, 10, pp. 219–223, 2 figs., 1925. [Received August, 1926.]

The results of experiments at Arlington near Washington, D.C., in the control of small brown patch of turf [*Rhizoctonia* sp.: see following abstract] by means of various chemicals are described. The best control was given by the mercury compounds, semesan, uspulun, corrosive sublimate, and corona 620 and 640, applied at the rate of 1 lb. in 50 galls. water per 1,000 to 3,000 sq. ft. on 26th August and 8th September, 1925. Copper compounds were of no value and formalin afforded only temporary protection. It is pointed out that the control given by corrosive sublimate (1 lb. per 3,000 sq. ft.) was fully equal to that obtained with the chlorophenol mercury compounds at about one-sixth of the cost of the latter.

MONTEITH (J.). **The brown-patch disease of turf: its nature and control.**—*Bull. U.S. Golf Assoc., Green Sect.*, vi, 6, pp. 127–142, 9 figs., 1926.

In this comprehensive account of the brown patch disease of turf [see preceding abstract], the writer distinguishes two types of infection known, respectively, as large and small brown patch. The former is caused by *Rhizoctonia solani*, and is prevalent in the southern section of the bent grass [*Agrostis*] area. It appears suddenly as large discoloured areas several feet across, and is associated with a blackening of the affected blades and a fine cob-web-like growth [see this *Review*, iv, p. 38; v, p. 234] round the patch. The latter form of the disease occurs in patches generally limited to about the size of a silver dollar, hence its popular name of 'dollar spot'. The turf develops a moth-eaten, bleached appearance, most of the grass being killed to the ground. This type of brown patch is stated to be due to a species of *Rhizoctonia*, distinct from *R. solani* and characterized by a fluffy, white mycelium and by the absence of the typical hard, black sclerotia. Large brown patch may be controlled by Bordeaux mixture, but the small type has been found amenable only to mercury compounds. The use of the resistant Washington and Metropolitan strains of creeping bent [*Agrostis maritima*] is recommended.

MONTEITH (J.). **Corrosive sublimate as a control for brown-patch.**—*Bull. U.S. Golf Assoc., Green Sect.*, vi, 7, pp. 151–155, 2 figs., 1926.

Further tests having confirmed the results obtained in the previous year [see preceding abstracts], recommendations are given for the control of brown patch of turf by the application of finely

powdered corrosive sublimate in an ordinary light topdressing of compost at the rate of 4 to 8 oz. per 1,000 sq. ft. Should infection develop when the application of a topdressing is inadvisable, the sublimate may be sprinkled or sprayed on the turf at the rate of 5 oz. in 50 galls. water per 1,000 sq. ft. It is pointed out that this solution contains more than three times as much active mercury as an equivalent solution of uspulun or semesan, which contain 70 per cent. of inert material.

PAPE (H.). **Die Sclerotium-Krankheit der Wiesengräser, insbesondere des Rohrglanzgrases.** [The *Sclerotium* disease of meadow grasses, especially of Reed Grass.]—*Illus. Landw. Zeit.*, xlvi, 23, pp. 295–296, 4 figs., 1926.

Little attention is stated to have been hitherto paid to a disease of reed grass (*Phalaris arundinacea*) and other meadow grasses caused by *Sclerotium rhizodes*, which of recent years has frequently occurred in epidemic form during May and June in German river basins.

Conspicuous symptoms of the disease are the bleached, dry, bent aspect of the rolled leaves and their termination in a long, pale tendril, the basal portion remaining normally green and flat. The fact that the apex of the tendril on each leaf (except the lowest) adheres to the rolled portion of the next leaf, forming a kind of loop, imparts a peculiar, concatenate aspect to the haulm. The white mycelium of the fungus extends along the midrib of the leaf, producing a dry, pale stripe in the tissue of the green portion. The white (later brownish and finally dark grey to black), oval or spherical sclerotia, measuring 1 to 4 mm., are found both on the tendril and on the flat portion of the lamina.

A résumé is given of Stout's investigations on *S. rhizodes* (*Wisconsin Agric. Exper. Stat. Res. Bull.* 18, p. 207, 1911), the hosts of which are also listed, with the authority for each. The writer considers it doubtful whether the fungus described by Hungerford as attacking wheat in Idaho [see this *Review*, iii, p. 267] is identical with *S. rhizodes*, the description pointing rather to infection by *Typhula graminum*.

The disease, which greatly reduces the yield and impairs the quality of the hay, cannot be effectively combated in the light of the present inadequate knowledge concerning the causal organism. The only recommendation which can be made is for the very early cutting of the affected grass and the destruction of diseased material. It might also be possible, where moisture conditions permit, to make an early spring cutting of the meadows to remove the affected leaf tips before the formation of sclerotia.

AGOSTINI (ANGELA). **L'Alternaria lolii-temulenti sp. n. e la sua presenza nelle cariossidi di Lolium temulentum L.** [*Alternaria lolii-temulenti* sp. n. and its occurrence in the caryopses of *Lolium temulentum* L.]—*Rend. R. Acc. Fisiocratici, 1926*, 8 pp., 1 fig., 1926. [Abs. in *Riv. Pat. Veg.*, xvi, 7–8, p. 183, 1926.]

A new species of *Alternaria* has been isolated by the author from infected caryopses of *Lolium temulentum* and named *A. lolii-*

temulenti. Reference is made to a similar infestation of *L. temulentum* recorded in Italy in 1923, but the cause of which was then unnamed. Sporulation occurs invariably under moist conditions, whilst under dry conditions the fungus may remain dormant for many years. No actual damage is done to the plant.

TAYLOR (H. V.). **The importance of applied biology in modern fruit growing.**—*Journ. Pomol. and Hort. Science*, v, 3, pp. 170–177, 1926.

In the present paper, which was read in February, 1926, before the Association of Economic Biologists in London, the author points out, and illustrates by some concrete examples, the necessity for closer co-operation between fruit growers and biologists. As instancing this need, it is pointed out that apple growers have at present to face a demand for fruit with a clean, bright skin, free from blemish, while the size and the flesh quality of the apples are also of importance. Such fruit can only be obtained from orchards where insect pests and diseases are rigorously kept under control. Examples are given of the prices commanded by the different grades of apples in Canada, the United States, and England, the presence or absence of insect or fungous injury playing an important part in the grading. Of phytopathological interest are the following figures taken from the books of the Fruit Packing Station at Fort William, Nova Scotia. The total crop in 1924 of a grower who sprayed his trees six times during the season, graded as follows: grade 1, 76 per cent.: grade 2, 14 per cent.; domestic, 7 per cent., and grade 3, 3 per cent.; while the crop of another grower who sprayed only twice yielded only 130 barrels of grade 1, out of a total of 458 barrels. At the Cottenham Packing Station, Cambridgeshire, the unblemished grade comprised only 2 out of 759 boxes of dessert varieties and 548 out of 2,826 boxes of culinary varieties, over 90 per cent. of the blemishes in the lower grades being due to scab [*Venturia inaequalis*].

DE VILLIERS (F. J.). **Physical and chemical analyses of papers employed for wrapping fruit.**—*Dept. of Agric. S. Africa, Science Bull.* 47, 19 pp., 2 figs., 3 diags., 1926.

It is shown in this paper that the indiscriminate use of all kinds of material for wrapping fruit destined for export is liable to cause serious damage. Some types of paper serve as a nutrient medium for the germination and development of fungi and bacteria, owing to the presence of nitrogenous compounds in the sizing material. In a test in which strips of various kinds of paper were kept with one end dipping into water, in cotton wool stoppered bottles, in an incubator at 80° F., or under conditions of higher humidity but lower temperature, foolscap was found to be heavily mottled with fungus colonies at the end of three weeks, whereas none of the ordinary fruit wrapper papers showed any growth.

The so-called 'coronite' paper commonly used in America for wrapping fruit is treated with oil and is stated to prevent the development of scald in apples [see this *Review*, v, p. 369]. Some of the grease-proof papers employed in South Africa for the same

purpose are more or less impermeable to air and moisture and their use should be abandoned.

HATTON (R. G.), WORMALD (H.), & WITT (A. W.). **On 'burr-knots' of fruit trees.**—*Journ. Pomol. and Hort. Science*, v, 3, pp. 195–204, 2 pl., 1926.

A detailed account is given of the tumour-like swellings common on certain varieties of apple and quince, which have also been observed by the authors on several plum seedlings and on some plum varieties used as root stocks, and are commonly known among fruit-growers and nurserymen in England as burr-knots or root knots. All attempts to isolate a pathogenic organism from these swellings have given negative results, and the authors agree with the findings of Miss Brown [see this *Review*, iii, p. 572] and of Swingle [ibid., v, p. 166] that they have no connexion with crown gall or hairy root caused by *Bacterium tumefaciens*.

NOBLE (R. J.). **Control of 'hairy-root' of Apple.**—*Agric. Gaz. New South Wales*, xxxvii, 7, p. 544, 1926.

Hairy root of apple (*Bacterium tumefaciens*) [see this *Review*, v, p. 494] is stated to be quite incurable once infection is established, but the disinfection of grafting implements, stocks, and scions in the nursery may to some extent prevent the occurrence of the disease. In general, however, the planting of stock showing symptoms of hairy root is not to be recommended. On superficial examination it is difficult to distinguish this condition from a type of root development which is characteristic of the Northern Spy variety.

WALLACE (R. H.). **The production of intumescences upon Apple twigs by ethylene gas.**—*Bull. Torrey Bot. Club*, liii, 6, pp. 385–399, 2 pl., 1926.

After a review of the literature dealing with the toxic effect of illuminating gas on plants and showing that this effect is probably chiefly due to small amounts of ethylene [see also this *Review*, iii, p. 735], the author gives a preliminary report of the results obtained by him in experiments conducted during two consecutive years in which cut woody twigs of various trees and shrubs were exposed to a known concentration of ethylene for a single period of time, varying from two to 48 hours, after which they were kept in a moisture-saturated atmosphere free from the gas.

About half of the 47 species of plants tested showed no visible response. The susceptible species varied greatly in their response to the action of the gas, from proliferation of cells in the lenticels of the cortex in *Sambucus*, *Syringa*, *Catalpa*, and several others, to a most pronounced type of intumescence, involving the formation of loose, almost white masses of proliferated cells, in the buds, apices, and internodes of twigs of *Pyrus malus* (varieties Transparent apple and cultivated crab apple), *P. ioensis*, and *Ginkgo biloba*. Concentrations greater than one part of ethylene in 4,000 parts of air showed little or no increased intensity of the reaction. At least 80 per cent. of the twigs that normally formed a callus in the controls showed an inhibition of callus formation after an

exposure to a low concentration of ethylene. The gas had no apparent effect on the chlorophyll in the chlorenchyma of woody stems.

HEALD (F. D.) & SPRAGUE (R.). **A spot-rot of Apples in storage caused by Botrytis.**—*Phytopath.*, xvi, 7, pp. 485–488, 1 fig., 1926.

A brief description is given of a storage rot of apples observed since 1921 in the north-west of the United States, which differs from the common rot caused by *Botrytis cinerea* in the presence, in the rotted area, of darker spots centred around the lenticels. These spots are brownish-red rings of 2 to 3 mm. in diameter, each showing a pale or whitish area in the centre. When the diseased apples were left in damp chambers in the warm laboratory for a few days, the spots lost their definition and spread out as blotches on the surface of the fruit. The fungus isolated from such spots was practically identical with *B. cinerea*, but produced a marked red pigmentation of the substratum in culture. Artificial inoculation experiments with this organism and with pure cultures of *B. cinerea* produced much the same type of rot, and it was shown that the spotting of the apples depends on the development of the rot at low temperatures. Re-isolations yielded fungi identical with the inoculants; the strains showing the red coloration of the substratum retaining this character throughout the experiments.

ZELLER (S. M.). **Observations on infections of Apple and Prune roots by Armillaria mellea Vahl.**—*Phytopath.*, xvi, 7, pp. 479–484, 3 figs., 1926.

The root rot caused by *Armillaria mellea* is stated to be a serious and widespread disease of orchard trees, affecting particularly the prune, and to a less extent the apple, in the north-west of the United States, especially in that portion of the Pacific Coast States west of the Cascade Mountains. From observations carried out since 1922, the author concludes that infection of apple and prune roots by this fungus may occur in at least three ways, namely, through wounds, at points of contact of diseased and healthy roots, or through the rupture of the bark parenchyma at the point of emergence of young lateral roots. When infection occurs at the point of contact of diseased and healthy roots, it is thought probable that the fungus penetrates through the healthy bark which has been acted upon by toxic substances developing in the tissues decayed by *A. mellea.*

LEBEDEVA (Mlle L. A.). Черная гниль фруктовых деревьев. [Black rot of fruit trees.]—*La Défense des Plantes*, Leningrad, ii, 7, pp. 588–592, 1926.

A detailed, popular account is given of *Sphaeropsis malorum* (*Physalospora cydoniae*) which is stated to be very widespread in many parts of Russia both on apples and on pears, and occasionally also on the quince. The biological identity of the forms attacking the apple and pear was proved by the author by successful cross-

inoculations, some details of which are given. The observation was made that trees suffering from chlorosis, or of which the vitality was lowered from any cause, were most liable to the attacks of the fungus, this leading the author to believe that the organism is a weak parasite, in which opinion she is confirmed by the fact that for the most part it occurs in association with other facultative parasites or saprophytes, namely: *Nectria ditissima* [*N. galligena*], *Cytospora capitata*, *Macrophoma malorum*, *Phyllosticta mali*, *Coryneum microstictum*, and *Monilia fructigena*. In all cases where *P. cydoniae* was found forming cankers on the stems of the trees, close investigation showed that the latter had suffered from frost injury or, very frequently, from attacks of *Myxosporium malicorticis* Potebn. [*Discosporium pyri* v. Hoehn.], which is stated to be very prevalent in some regions. The paper terminates by the usual recommendations for the control of the disease.

Experiencias de un nuevo tratamiento contra el chancro del Manzano. [Experiments with a new treatment against Apple canker.]—*Bol. Soc. Nat. Agric. Chile*, lvii, 6, p. 353, 1926.

Excellent results in the control of apple canker (*Nectria ditissima*) [*N. galligena*] are stated to have been obtained in Chile by the application of a mixture known as 'chancrina', which is prepared by a member of the staff at the Escuela Práctica de Agricultura at Temuco. The preparation has also been found efficacious against gummosis of cherry trees.

MAURIZIO (Fräulein A.). **Spezialisierung der Podosphaera oxyacanthae de Bary.** [Specialization of *Podosphaera oxyacanthae* de Bary.]—Reprinted from *Mitt. Naturforsch. Gesellsch. Bern, 1926*, 2 pp., 1926.

The results of a series of cross-inoculation experiments with conidia of *Podosphaera oxyacanthae* from various hosts are briefly described. Conidia from two quince seedlings infected in the spring of 1926 by the overwintered mycelium gave positive results on quince, pear (very slight), *Pirocydonia danieli*, and *P. winkleri*. No infection occurred on 11 other hosts, including *Crataegus oxyacantha*, apple, peach, and cherry-laurel (*Prunus laurocerasus*).

Conidia from *C. oxyacantha* infected *C. oxyacantha*, *C. punctata*, *C. pentagyna*, medlar (*Mespilus germanica*), pear, and *Crataemespilus grandiflora*; while negative results followed the inoculation of quince, apple, peach, and eight other plants.

Conidia from *Sorbus* [*Pyrus*] *aucuparia* gave positive results only on *P. aucuparia*, though *P. aria* is also known to be susceptible.

These results are considered to show that the strains of *P. oxyacanthae* on quince, *Crataegus*, and *Pyrus* are biologically independent. The pear, though susceptible to infection by the mildew both from quince and *C. oxyacantha*, does not constitute a 'bridging species', since the strain from quince, reisolated from pear, is not transmissible to *C. oxyacantha*, and vice versa.

LAUBERT (R.). **Einiges zur Naturgeschichte, Bedeutung und Bekämpfung des Birnen-Mehltaues.** [Notes on the life-history, importance, and control of Pear mildew.]—*Obst. und Gemüsebau*, lxxii, 14, pp. 205–206, 1 fig., 1926.

A brief popular account is given of the life-history of *Podosphaera leucotricha* and of its rapid spread in German orchards during the last twenty years [see also this *Review*, iii, p. 339]. The apple is, in the writer's opinion, likely to remain the chief host of the fungus, but several recent observations of its occurrence on the shoots, flowers, and fruits of pears suggest the advisability of precautionary measures against the further spread of the disease on this host. Good general cultivation should be supplemented, where necessary, by the application of lime-sulphur, solbar, or other sulphur preparations.

HESLER (L. R.). **Peach disease conditions in Ohio.**—*Ohio Agric. Exper. Stat. Bimonthly Bull.*, xi, 3, pp. 110–114, 1926.

The author recommends the following spraying programme for the control of peach diseases in Ohio orchards.

An autumn, instead of a spring spraying of lime-sulphur, 1 in 15, or dry lime-sulphur, 6 lb. in 50 galls., is now advised against peach leaf curl [*Taphrina deformans*], but should not be given until there has been a good hard frost to harden the wood. Four summer sprayings are stated to be sufficient for the control of the other diseases [including brown rot (*Sclerotinia cinerea*)] which are amenable to spraying, the first being given after the bloom has fallen, then at 2-week intervals in wet weather or at 3-week intervals if dry, the last application being given two or three weeks before picking.

Dry-mix sulphur lime (6 lb. sulphur, 3 lb. hydrated lime, 2 oz. kayso or ground glue in 50 galls.) is now generally used, with the addition of lead arsenate ($1\frac{1}{2}$ lb. powder or $2\frac{1}{2}$ lb. paste) in all applications except the last, to control curculio, which besides injuring the fruit, transmits the brown rot fungus.

Satisfactory results have also been obtained with sulphur-lead arsenate dust (80–10–10) for the earlier applications and sulphur dust alone (80–20) for the last. Careful handling of the fruit during picking and packing is emphasized as a further safeguard against damage by brown rot.

Injudicious use of lead arsenate is stated to be responsible for two types of injury, on the leaves and on the twigs, respectively, which are common on peaches in Ohio [see also this *Review*, v, p. 39].

STEVENSON (A. W.). **Lime-sulphur affects canned Cherries.**—*Better Fruit*, xxi, 1, p. 10, 1926.

Experiments carried out at the Research Laboratory, National Canners' Association, Washington, indicate that under certain conditions, spraying with lime-sulphur compounds may cause 'hydrogen springers' in canned cherries. The following experimental lots were canned: (1) unwashed sprayed; (2) washed sprayed; (3) unsprayed; (4) unsprayed but with one c.c. of the 1 to 300 lime-

sulphur spray added to each can. The spraying was done only a few days before picking and canning.

With the exception of the control, cans from each lot showed a gradual loss of vacuum, indicating the liberation of hydrogen, accompanied by an abnormal sulphide-like flavour which was distinctly apparent in lots 1 and 4 about four months after packing. A faint odour of hydrogen sulphide was also detected in some cans, and in all, except the control, there was sulphide staining of the tin. No 'springers' were actually developed until some eight months after picking, when both lots 1 and 4 were affected. The importance of a very thorough washing of fruit showing signs of adhering spray material before canning is, therefore, emphasized.

ESMARCH (F.). **Faulende Erdbeerfrüchte.** [Decaying Strawberry fruits.]—*Die Kranke Pflanze*, iii, 7, p. 138, 1926.

A number of cases of fruit rot of unripe strawberries, due to *Botrytis cinerea*, have been reported during the current season to the Plant Protection Service in Dresden. Affected fruits first show light brown spots which are soft to the touch in comparison with the healthy portions, and eventually the entire berry turns brown and rots. The disease, which is favoured by humid conditions, may be counteracted by surrounding the plants with wood shavings or similar material, and by the cultivation of long-stemmed varieties.

Gooseberry rust.—*Scottish Journ. of Agric.*, ix, 3, p. 308, 1 pl., 1926.

A brief description is given in the present note of the symptoms caused by the gooseberry cluster cup rust (*Puccinia pringsheimiana*) both on the gooseberry and on its alternate host, the sedge [*Carex*]. As illustrating the connexion between the presence of both hosts and the completion of the life-cycle of this fungus, an outbreak is cited on the gooseberry in a Highland village, the source of which was traced to a byre which had been recently thatched with sedges bearing numerous teleutospores of *P. pringsheimiana*.

REINKING (O. A.). **Banana freckle and leaf spot.**—*Mycologia*, xviii, 4, pp. 185–186, 1926.

Careful examination made in Hawaii and the Philippine Islands has established that the banana fruit freckle or black spot disease, described by Carpenter from Hawaii as due to *Phoma musae* n. sp., and reported by Lee from the Philippines [see this *Review*, i, p. 387], is caused by the same fungus that produces a leaf spot disease of banana in the latter. Since Carpenter's *Phoma musae* has been found to agree with the earlier *P. musae* (Cke) Sacc., an organism that was subsequently redescribed as *Macrophoma musae*, it is suggested that Carpenter's name be reduced to a synonym of *Macrophoma musae* (Cke) Berl. & Vogl.

While conducting the investigation in Hawaii it was observed that the Gros Michel banana [*M. sapientum*] of Central America appeared to be resistant to the disease, as no infection was noted on this variety even when growing adjacent to heavily infected

bananas of the Chinese or Dwarf variety [*M. cavendishii*]. The so-called red variety of Saba (Sabang Pula) in the Philippines is severely affected on leaf and fruit.

DEL GUERCIO (G.). **Nuove osservazioni sulla tignuola dell' Olivo.** [New observations on the Olive moth.]—*Bull. R. Soc. Toscana Orticolt.*, Ser. 4, xi, pp. 8–14. [Abs. in *Riv. Pat. Veg.*, xvi, 7–8, p. 198, 1926.]

The olive moth [*Prays oleellus*] is stated to cause considerable trouble in Tuscany. In 1925 a black mould was observed to be attacking these insects. The fungus concerned resembles *Cladosporium herbarum* and is being more closely studied.

DEMAREE (J. B.) & COLE (J. R.). **Commercial control of Pecan scab.**—*U.S. Dept. of Agric. Circ.* 386, 8 pp., 1926.

Pecan scab (*Fusicladium effusum*) [the symptoms of which are briefly described: see this *Review*, iv, p. 73] is widely distributed throughout the south-eastern States of America. Of the more popular varieties growing within the region of the most frequent summer rains (a narrow belt along the Gulf coast from Baton Rouge, Louisiana, to Tallahassee, Florida), more than half, including San Saba, Delmas, Georgia, Alley, Schley, Pabst, Van Deman, and Mobile can be classed as highly susceptible. Good control may be effected by the application of 3–3–50 Bordeaux mixture (1) immediately after pollination (from 1st to 15th May in southern Georgia); (2) three to four weeks later; and (3) two to three weeks after (2). This schedule may be supplemented, if necessary, by the application of 1 in 50 lime-sulphur three to four weeks after (3). Directions for orchard sanitation are also given.

PETRI (L.). **Necessità di un controllo statale sul grado di efficacia degli anticrittogamici ed insetticidi di nuova fabbricazione o non ancora largamente sperimentati.** [Necessity of state control in regard to the degree of efficacy of new or insufficiently tested fungicides and insecticides.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 181–184, 1926.

The necessity for the establishment of an official institution in every country for the testing and examination of fungicides and insecticides was emphasized at the International Conference of Phytopathology and Economic Entomology held at Wageningen in 1924 [see this *Review*, iii, p. 408]. The author urges the importance of bringing into effect the suggestion put forward by Dr. H. Faes (Lausanne Viticultural Station) for a system of experimentation to be carried out by the central and provincial phytopathological institutions in each country.

Legal measures have recently been taken in Italy to exclude fraud in the preparation of commercial agricultural products, but this does not render the proposed scheme superfluous. The central station, or in the case of Italy, the three principal institutes situated at Rome, Florence, and Portici, collaborating, should have the right of condemning or encouraging the sale of the tested products, after having received from the various provincial experiment stations full particulars of tests made with them.

Bewley (W. F.). **Practical soil sterilization by heat for glasshouse crops.**—*Journ. Min. Agric.*, xxxiii, 4, pp. 297–311, 4 figs., 1926.

The author gives a detailed account (including figures of costs taken from representative growers) of three methods of steam sterilization of glasshouse soils for the prevention of disease and the maintenance of fertility, practised in the Lea Valley, where tomatoes are chiefly grown. These are the small grid method, the tray method, and the spike method, the first named being preferred in those cases where complete sterilization to a depth of some 18 inches to two feet is required on account of the presence of soil-borne disease. Steaming by this method once in four years is sufficient.

Of the chemical methods of sterilization, cresylic acid (pale straw-coloured, 97 to 99 per cent. purity, used in a dilution of 1 in 40) has been much used. In a test carried out by a grower on a crop of tomatoes, the following results were obtained: steam, 50·25 tons of tomatoes per acre; cresylic acid, 43 tons; and control, 28 tons.

The cost of steaming is roughly estimated at about £200 per acre once in four years, and that of sterilization with cresylic acid £45 every year, exclusive of the cost of labour in the latter case. Against these costs, there is a saving in fertilizers.

Riehm (E.). **Das Trockenbeizeverfahren.** [The dusting process.] —*Tech. Landw.*, vii, 5, pp. 97–99, 1 fig., 1926.

In this paper the writer discusses some of the problems connected with the disinfection of seed-grain by the dusting process, with special reference to the possibility of its general adoption in Germany [see this *Review*, v, p. 238]. The inconsistency of some of the results obtained in dusting experiments in the United States and Germany is briefly referred to, and various questions of technique which require elucidation are outlined. An account is given of some German appliances for dusting seed-grain [ibid., v, pp. 479, 480]. Among other advantages attaching to the substitution of dusting for liquid seed treatment are economy (the cost of dusting 10 cwt. of wheat being calculated at Mk. 1·55 to 1·80 compared with Mk. 4 to 5 for liquid disinfection); possibility of indefinite storage without risk of reinfection; absence of injury to germination; and the application of the method to beet and flax seed, neither of which is amenable to steeping. Preliminary tests in Holland have indicated that the incidence of *Phoma* [*betae*] on beet and of *Botrytis* [*cinerea*] on flax may be reduced by dusting.

Bernatsky (J.). **Kupfer gegen Oidium.** [Copper against *Oidium.*] —*Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, vi, 7, p. 52, 1926.

The writer has repeatedly obtained satisfactory control of *Peronospora* [*Plasmopara viticola*] and *Oidium* [*Uncinula necator*] on the vine and of mildew (*Oidium*) on vegetable marrow leaves by treatment with Bordeaux mixture or perozid (containing chiefly cerium sulphate). In 1925 nosperal was also efficacious (though not equal to perozid) in the control of *Oidium* on vegetable marrow and of *P*[*seudoperonospora*] *cubensis* on melons and

cucumbers. A dust made by powdering dried Bordeaux mixture can also be recommended for the control of *U. necator* on the vine. The common belief that copper fungicides are not effective against the true mildews is considered, in the light of these results, to be devoid of foundation.

HILTNER (L.). **Pflanzenschutz nach Monaten geordnet.** [Plant protection arranged by months.]—E. Ulmer, [Stuttgart], 1926. [Abs. in *Zeitschr. für Pflanzenkrankh.*, xxxvi, 7–8, p. 242, 1926.]

This posthumous edition of L. Hiltner's plant protection calendar, which first appeared as a supplement to *Praktische Blätter* in 1909, has been revised by E. Hiltner, K. Flachs, and A. Pustet. The text is stated to contain a number of alterations and additions necessitated by the great activity of the plant protection movement during the past sixteen years.

Damping-off.—*Scottish Journ. of Agric.*, ix, 3, pp. 314–316, 1926.

Damping-off of seedlings is due to two factors, namely, cultural conditions predisposing the seedlings to infection, and certain fungi (chiefly *Phytophthora* spp., *Pythium de Baryanum*, and *Rhizoctonia* spp.) which become parasitic under such cultural conditions. It may be prevented by avoiding too thick sowing and by good aeration and exposure to sunlight of the seedlings. When infection is established in the soil, the disease may be controlled by soil sterilization either by heat (dry heat or live steam) or by the application of disinfectants, such as formalin, Cheshunt compound [see this *Review*, i, p. 373], or permanganate of potash. The methods of use of these disinfectants are briefly described.

RAMOS (J. C.). **Pythium damping-off of seedlings.**—*Philipp. Agric.*, xv, 2, pp. 85–97, 1 pl., 1 fig., 1926.

A large variety of seedlings are stated to be liable to serious attacks of damping-off (*Pythium de Baryanum*) in the nurseries of the College of Agriculture, Los Baños, Laguna, Philippine Islands.

The causal organism [the morphological, cultural, and taxonomic characters of which are described, with brief references to previous literature] infects the stems of tobacco, lettuce, tomato, papaw, cabbage, radish, chilli pepper (*Capsicum annuum*), and other seedlings just above soil-level, producing sunken, water-soaked lesions. The affected plants lose their turgidity, fall over, and finally decay.

In a series of tests with various seedlings sown in sterilized and inoculated soil, *Luffa acutangula* and *Psophocarpus tetragonolobus* were resistant to the fungus, while tobacco and okra (*Abelmoschus* [*Hibiscus*] *esculentus*) were very susceptible, showing 60 to 70 and 30 per cent. infection, respectively. Pechay (*Brassica pekinensis*), mustard (*B. juncea*), tomato, and eggplant all showed 21·8 to 35·9 per cent. infection, while radishes, cowpeas (*Vigna sinensis*), and turnips were comparatively resistant (5 per cent. infection), and rice and *Phaseolus vulgaris* were highly so.

Experiments were further conducted to determine the relative

susceptibility of ten different seedlings to *Rhizoctonia solani*, *Sclerotium rolfsii*, and *P. de Baryanum*. Peanut (*Arachis hypogaea*), okra, tobacco, papaw, *Brassica juncea*, and tomato were found to be highly susceptible to *S. rolfsii*; chilli pepper, okra, tobacco, papaw, and *B. juncea* to *P. de Baryanum*; and chilli pepper, radish, okra, and *B. juncea* to *R. solani*.

In another series of tests, *S. rolfsii* was found to be more capable than *P. de Baryanum* of infecting more or less woody plants. *R. solani* was more severe on seedlings susceptible to *S. rolfsii* than on those attacked by *P. de Baryanum*. Most of the seedlings became infected by any of the organisms from two to five days after emergence.

The development of *P. de Baryanum* and the severity of infection are favoured by excessive moisture, high temperature, and dense planting. A considerable reduction of infection may be effected by soil sterilization with heat, or by the application of sulphuric acid (1 per cent.) or of uspulun or U-175 (0·75 to 1 per cent.) at the rate of 250 c.c. per 3 kg. of soil four or five days before sowing.

BEAUVERIE (J.). **Sur les modes de dégénérescence des chloroplastes, particulièrement dans le parasitisme.** [On the modes of degeneration of the chloroplasts, particularly in parasitism.]—*Comptes rendus Acad. des Sciences*, clxxxiii, 2, pp. 141–143, 1926.

Two modes of degeneration of the chloroplasts of plant tissues are described. In the case of tissues parasitized by a fungus and consequently in a hypertonic condition the chloroplast assumes a granular aspect and undergoes a fatty or oily degeneration, the green pigment being dissolved in the drops thus produced. Another mode of degeneration has hitherto been observed only in the case of the foliar parenchyma of leaf roll potatoes. The chloroplast swells into a large hyaline ball with hyaline granules at the periphery, while the green pigment remains in the form of a hood at one extreme. This disease produces a hypotonic condition in the cells, associated with the formation of starch in the leaves as a result of the transformation of mono- into polysaccharides.

KLEBAHN (H.). **Die Alloiophyllie der Anemone nemorosa und ihre vermutliche Ursache.** [Alloiophylly of *Anemone nemorosa* and its probable cause.]—*Planta, Arch. Wissensch. Bot.*, i, 4, pp. 419–440, 1 pl., 4 figs., 1926.

In this paper the author describes further results of his investigation of a malformation of *Anemone nemorosa*, first reported in 1897 (*Ber. Deutsch. Bot. Gesellsch.*, xv, p. 527), and now termed alloiophylly. Affected plants show a strikingly spreading habit and the leaves are frequently much thickened and misshapen, with abnormally shallow indentations. The stem or leaf stalks are almost always more or less noticeably thickened. The flowers are mostly suppressed, those that occasionally develop being deformed. Certain anatomical modifications correspond with these symptoms.

In the glandular hairs a minute fungus sometimes occurs, which the author has described as *Trichodytes anemones* [loc. cit.] and

formerly considered might be the cause of the disease. That this view was erroneous is shown by the very frequent absence of the organism from affected plants, and further by its absence in the earliest stages of the disease. It is hardly likely, moreover, that an attack on the hairs could exert such a powerful influence on the plant.

Experiments extending from 1908 to 1924 showed that the rhizome of diseased anemones and healthy rhizomes grown in proximity to infected plants frequently produced diseased progeny the following year. The disease can also be transmitted to healthy plants by placing parts of infected anemones in the soil; by smearing the buds of healthy plants with the sap of infected ones; or by mixing the soil in which diseased plants have grown with that of healthy plants. These data led the author to conclude that the disease is infectious and due to an organism capable of living in the soil, in the underground parts of the plant, and in the buds.

Cytological examination of infected material showed the presence, in the living phloem cells, of numerous structures, very variable in form, from thin threads, 3 to 30 by 0·2 to 0·5 μ, to oval or elongated bodies, 6 to 8 by 2 to 2·5 μ, usually curved and frequently thickened at one end or in the middle. The contents of these bodies are difficult to differentiate; they usually appear as homogeneous masses, but in the thickened portions a darkly staining coating is sometimes visible.

These structures occur in the rhizome, in young stems and petioles, and in the buds. Sometimes they are found only in small pockets of tissue, and whether they are ever completely absent from diseased plants, as sometimes appears to be the case, is difficult to determine. So far they have been observed in over twenty individuals.

The significance of these bodies, which the author, for convenience, names *Scolecosoma anemones*, has not been determined, but if the view that they are organisms be accepted, then they must be regarded as parasites. Against this hypothesis must be mentioned the fact that they are not constantly found in diseased individuals, but this may be due to their being overlooked and not to their real absence. The manner in which the bodies reach the phloem also remains to be explained, but in one case they were discovered between the rhizome parenchyma and the epidermis of a root that was emerging through the parenchyma. Attempts to isolate them have yielded only bacteria.

Although no definite nuclear structure has been discovered in these bodies, yet the author considers there are sufficient grounds for regarding them tentatively as parasitic organisms of uncertain systematic position, possibly intermediate between the bacteria and the flagellates. The paper concludes with a discussion on the similarity of the *Scolecosoma* with Nelson's bodies and the occurrence of protozoa reported by various authors in the virus diseases.

Walker (M. N.). **A comparative study of the mosaic diseases of Cucumber, Tomato, and Physalis.**—*Phytopath.*, xvi, 7, pp. 431–458, 1926.

The scope of the present work was to compare the properties of

the infective principle, or virus, from typical cases of mosaic on the cucumber, tomato, and cultivated ground cherry (*Physalis pubescens*); and also to determine the changes that occur in any one of these viruses when transferred by cross-inoculation to either of the other two hosts. The tomato was chosen as the representative of the Solanaceae, as the mosaic disease of this plant is apparently identical with that of tobacco, and the cultivated ground cherry was chosen because it was recently shown by the author to be an intermediate host in cross-inoculations from the tomato to the cucumber [see this *Review*, v, p. 340].

The experiments [which are described in detail and the results of which are given in tabular form] showed that while the properties of the expressed juices from mosaic tomato and ground cherry plants are almost the same, the expressed juice from mosaic cucumber is incapable of withstanding, in any comparable degree, ageing, drying, heating, and treatment with alcohol, although all three viruses were infective at 1 in 10,000 dilution and all passed through Berkefeld filters. No change occurred in the properties of the expressed juices from tomato plants inoculated from the ground cherry or vice versa, while the juice expressed from the ground cherry inoculated with the extract from mosaic cucumber behaved in the same way as the juice from ground cherry plants inoculated with the extract from mosaic ground cherry. The juices extracted from cucumber plants inoculated with extracts from mosaic ground cherries, or with the extract from mosaic tomato plants by means of the ground cherry as intermediate host, showed no differences from the typical cucumber virus. These results indicate that the properties of the mosaic virus of a given plant may be changed by transferring it to another host. This fact, together with the consideration that the properties of the viruses from mosaic plants of a particular species appear to be the same, independent of the source of infection, tends to show that there may be a single causal agent for all the mosaic diseases studied in the present work.

Experiments in which the extracts from mosaic plants were treated at different temperatures showed that the thermal death point of the infective principle and the temperature at which coagulation of the extract occurs are practically the same. In experiments in which alcohol was added to the extract, coagulation also occurred, but there was apparently no correlation between the concentration of alcohol at which coagulation occurred and the one at which the virus was rendered innocuous. The author believes that by a combination of these two methods of coagulation, under delicately controlled conditions and with suitable filtration methods, a separation of the mosaic extracts into several parts may be possible, and that one of these parts will be closer to the actual virus than anything heretofore obtained.

GATES (R. R.). **Ultramicroscopic organisms of filterable viruses.** —*Nature*, cxvii, 2950, p. 692, 1926.

Barnard's observations on the filterable viruses [see this *Review*, iv, p. 687] are regarded as demonstrating the existence of a group of organisms as different from bacteria as the latter are from yeasts

or moulds. These organisms appear to multiply in two ways: (1) by the development of minute papillae on the surface of the vesicles; and (2) by the elongation of a vesicle into a flattened, hollow structure which then breaks up into a row or group of particles like the papillae, and having the same property of growing into vesicles. This process is comparable to some extent with gonidial formation in such bacteria as *Crenothrix.* The vesicle was found to be separable from the particle stage by filtration through a collodion membrane.

This group of ultramicroscopic organisms, in its extreme simplicity and modes of reproduction, approximates closely to the inorganic. The term 'cell', in the sense generally used by biologists, is regarded as inapplicable to these differentiated particles of protoplasmic material. It is questionable whether smaller organisms than these could show the essential phenomena of life. The writer suggests for the filterable viruses the name Protonta, to contrast them with the plant and animal unicells classed by Haeckel as Protista. There is at present no means of recognizing the possible existence of a world of organisms of this type, except in the case of those which are parasitic in animals and plants.

Investigations of the so-called d'Hérelle phenomenon [see this *Review,* v, p. 438] and of enzymes, by showing the condition of aggregation of these bodies, should help to indicate the exact extent of the gap separating such organisms from the strictly inorganic.

SIBILIA (C.). **Il batteriofago nella patologia vegetale.** [The bacteriophage in relation to plant pathology.]—*Boll. R. Staz. Pat. Veg.*, vi, 3, pp. 200–209, 1926.

In this paper the author summarizes the results of various investigations on d'Hérelle's bacteriophage in relation to plant pathogens [most of which have been noticed in this *Review*]. The transmissible lytic principle is stated to have been demonstrated up to the present in *Bacterium tumefaciens*, *Bacillus carotovorus*, *B. atrosepticus*, and a cabbage rotting bacillus [see this *Review*, iv, pp. 183, 753] and to have, in general, the same characters as have been demonstrated for bacteriophages of animal origin. On the bacteriophage of the nodule organism [*Pseudomonas radicicola*] of Leguminosae, exposure to ultra-violet rays at a distance of 30 cm. for 30 minutes to 2 hours is stated to have had no effect on its potency, whereas prolongation to 2½ hours resulted in its inactivation. The possibilities of rendering plants immune from the attack of certain parasites by means of soil inoculation with the lytic principle are stated to be under investigation. The fact that the bacteriophage is not necessarily limited to the infected portion of the plant has been demonstrated, since the presence of the lytic principle was noted in sections of the roots of Leguminosae without nodules, and from stems of the same plants.

NOGUCHI (H.). **Cultivation of Rickettsia-like microorganisms from the Rocky Mountain spotted fever tick, Dermacentor andersoni.**—*Journ. Exper. Med.*, xliii, 4, pp. 515–532, 4 pl., 1926.

A systematic study of 74 ticks, the infectivity or non-infectivity

of which was determined experimentally, showed the presence in some cases of several types of minute culturable bacteria, morphologically resembling the *Rickettsia* associated with Rocky Mountain spotted fever [see this *Review*, iv, pp. 112, 689]. The most commonly isolated was *Bacillus rickettsiformis* n. sp., those less frequently encountered being *B. pseudoxerosis* n. sp. and *B. equidistans* n. sp.

B. rickettsiformis is a lanceolate, fusiform, or rod-shaped, sometimes moderately motile organism, the average dimensions of which in young cultures are 0·3 by 0·75 μ; it is Gram-negative and stains light reddish-violet with Giemsa's solution.

B. pseudoxerosis is a non-motile, slender organism, measuring 0·3 to 0·5 μ in width and 0·4 to 2 μ in length in young cultures and 0·5 to 0·55 by 3 to 4 μ in older ones; it is somewhat resistant to Gram's stain.

B. equidistans is characterized by an appearance of uniform dispersion, an indication of capsule formation; it is non-motile, measuring 0·25 to 0·3 by 0·4 to 0·8 μ, Gram-negative, and staining reddish-violet with Giemsa's solution.

Initial cultures of all three organisms were obtained only on special media [the composition of which is indicated], but they gradually became adapted to ordinary substrata.

None of these organisms was pathogenic to the guinea-pig, rabbit, or monkey (*Macacus rhesus*). In morphological characters they resemble the forms found in smears and sections of the ticks, yet their presence bore no relation to infectivity. Immunologically they are not related to the spotted fever virus. All three are pleomorphic under cultural conditions, and the question arises whether or not these minute, non-pathogenic *Rickettsia*-like forms and the somewhat coarser symbionts found in *Dermacentor andersoni* [see next abstract] are morphological variations due to modifications in physiological conditions in the tissues in which the organisms are embedded. At all events, the differentiation of the non-pathogenic, *Rickettsia*-like organisms from *Dermacentroxenus rickettsi* is extremely difficult.

The possibility that *B. rickettsiformis* is a non-pathogenic phase of the spotted fever organism, comparable with the avirulent flagellate culture forms of *Leishmania* species, appears remote in view of the negative immunological data.

The hereditary transmission of *B. rickettsiformis* is clearly indicated by its presence in ovaries and egg cells, a characteristic also of the spotted fever organism (*Journ. Amer. Med. Assoc.*, xlix, p. 1278, 1907) and of other insect-borne rickettsiae.

Parker (R. R.) & Spencer (R. R.). **Rocky Mountain spotted fever. A study of the relationship between the presence of Rickettsia-like organisms in tick smears and the infectiveness of the same ticks.**—*Publ. Health Repts.*, Washington, xli, 11, pp. 461–469, 1926.

In connexion with an investigation of the etiology of Rocky Mountain fever, the writers examined a large number of infected and non-infected ticks (*Dermacentor andersoni*) [see preceding abstract], both wild and specially reared.

The resulting data [presented in tabular form] show that, although the majority of known infected adult ticks containing rickettsiae were infective, yet of each lot tested a small group of non-infective ticks contained morphologically identical rickettsiae, while yet another small group was infectious though the tick smears were entirely free of organisms. Of the wild ticks from a known infected area a considerable proportion contained rickettsiae indistinguishable from those associated with spotted fever, the smear and inoculation results of such ticks agreeing with those of the known infected group. A small proportion of wild ticks from a supposedly healthy area contained similar rickettsiae, none of which caused infection.

Some difficulty is experienced in accounting for the non-infective rickettsiae present in part of the known infected, laboratory reared ticks, and exhibiting morphological characters identical with those of the rickettsiae in infective ticks of the same group. They may represent an avirulent phase of the spotted fever virus. This accords with previous observations (*Publ. Health Repts.*, 28th November, 1925) of tick virus in a similar lot of known infected ticks, in which various degrees of virulence for guinea-pigs were demonstrated, ranging from a non-infective or immunizing phase in unfed, aestivating, or hibernating ticks to an active, highly virulent phase following feeding.

CLEMENT (E.). **The non-symbiotic and symbiotic germination of Orchid seeds.**—*Orchid Rev.*, xxxiv, 396, pp. 165–169, 3 figs., 1926.

In connexion with his previous experiments on the non-symbiotic germination of orchid seeds [see this *Review*, iii, p. 731], the writer emphasizes the importance of a suitable hydrogen-ion concentration of the medium. The best results were obtained during his lengthy experience when the P_H value was not below 6. The seedlings should be transferred direct from the culture tubes to sterilized fibre mixture in pots. Throughout the writer's experiments with *Odontoglossum*, *Cattleya*, *Cymbidium*, and *Miltonia*, germination has been practically 100 per cent.

In a preliminary experiment in the germination of orchid seeds by fungal aid, satisfactory results have hitherto been obtained on non-sugar-containing media at P_H 6·5 by the inoculation of *Cymbidium* with *Rhizoctonia repens* and of *Odontoglossum* and *Miltonia* with *R. lanuginosa*. No definite statement can yet be made, however, regarding the comparative merits of the symbiotic and non-symbiotic methods of germination.

BULTEL (G.). **Les Orchidées germées sans champignon sont des plantes normales.** [Orchids germinated without a fungus are normal plants.]—*Rev. Hort.*, xcviii, 6, p. 155, 1926.

Since his previous experiments in the aseptic cultivation of hybrid orchids [see this *Review*, iv, p. 365 and preceding abstract], the writer has consistently obtained successful results by the same method with large numbers of *Phalaenopsis* and *Miltonia*. The presence of the *Rhizoctonia* endophyte during the germination period does not appear to be essential either to the life or to the

flowering of orchids, some two-year-old plants cultivated by aseptic methods showing no trace of the fungus in their roots, though the author has not yet grown plants aseptically up to the flowering period. According to a recent statement (*Rev. Scient.*, p. 247, 24th April, 1926), seven specimens of moss from widely separated French forests yielded species of *Rhizoctonia* which were equally effective in producing germination as those originating from the natural habitat of the orchids in Brazil. It is of interest to note the existence of species of *Rhizoctonia* suitable for orchid germination in regions in which no indigenous terrestrial orchids were found.

SCHLUMBERGER [O.]. **Erkennung und Bewertung von Kartoffelkrankheiten bei der Saatenanerkennung.** [Recognition and estimation of Potato diseases in seed certification.]—*Mitt. Deutsch. Landw. Gesellsch.*, xli, 29, pp. 607–610, 1926.

After a general discussion on the nature of disease in plants, with special reference to the factors influencing the occurrence of various maladies of the potato in Germany, the writer gives some instructions for the recognition of different types of fungous infection and other diseases liable to be transmitted by the tubers, and for the estimation of their probable effect on the progeny. In connexion with the latter there are three categories to consider: (1) those in which the disease of the mother plant almost always involves the infection of the progeny; (2) where the disease of the mother plant may, but only under certain conditions, be transmitted by the tubers; and (3) diseases in which the causal organism, carried on tubers, may produce soil infection, so that not only the immediate progeny but successive potato crops on the affected area may be attacked.

Examples of group (1) are leaf roll, rosette, Barbarossa disease [see this *Review*, iii, p. 100], leaf curl, and other obscure forms of distortion. Generally speaking, the maximum permissible incidence of these diseases is 5 per cent. in Germany, compared with only 2 per cent. in the United States. Mosaic, wilt disease [*Verticillium albo-atrum* and *Fusarium oxysporum*], and bacterial ring disease [*Bacterium solanacearum*] also belong to the first group, but somewhat greater leniency may be exercised in the certification of crops affected by these diseases. *Rhizoctonia* [*solani*] is also included in this group.

To group (2) belong all diseases caused by wound or facultative parasites, e.g., blackleg [*Bacillus atrosepticus*], the maximum incidence of which is fixed at 10 per cent. Late blight (*Phytophthora infestans*) is another example of this category.

Powdery scab (*Spongospora solani*) [*S. subterranea*], the incidence of which in Germany is probably much higher than is generally known, is an example of the third group.

Wart disease [*Synchytrium endobioticum*] is the subject of special regulations.

Wart disease of the Potato: Infection tests.—*Scottish Journ. of Agric.*, ix, 3, pp. 302–304, 1926.

During the winter of 1925–1926 experiments were carried out

by the Board of Agriculture for Scotland with a view to devising a practical method of infecting potato tubers with wart disease [*Synchytrium endobioticum*] for the purpose of testing large numbers of varieties for resistance with a minimum of apparatus, laboratory space, and time. The method finally arrived at is a modification of that employed by Miss Glynne [see this *Review*, iv, p. 501]. The tubers tested are placed with their 'rose' [apical] end buried in moist sphagnum moss in Petri jars (four to a jar), which are kept uncovered in the laboratory at a temperature ranging from 10° to 20° C. Tepid water washings from tubers carrying freshly developing warts are applied to each tuber with a teaspoon, and sufficient is added every day to make the sphagnum bed very wet. Continuous excess of free water in the jars is to be avoided, but occasional drying up of the jars does not influence the result of the tests. The shortest period of incubation was 18 days, but the time ordinarily taken for the disease to develop was from 28 to 35 days. The result of one series of tests indicated the possibility of applying the test to tubers shortly after their harvest. Besides its simplicity, this method has the advantage that it can be repeated four or five times on the same variety or series of varieties between November and April of any year.

Useful results were also obtained with a modification of Spieckermann's and Kotthoff's method [ibid., iii, p. 600] in which the sphagnum was impregnated with powdered rotted wart tissue that had been subjected to over 10 degrees of frost. It was, however, found necessary for successful infection to carry out the test in the dark.

AUBERTOT (M.). **La flagellose des Euphorbes dans la Haute-Maurienne.** [Flagellosis of *Euphorbia* in the Haute-Maurienne.]—*Ann. Soc. Linn. Lyon*, N.S., lxii (1925), pp. 36–41, 2 figs., 1926.

In August and September, 1924, the writer found *Euphorbia cyparissias* at an altitude of 1,300 to 1,500 m. near Termignon (Savoy), heavily infected by *Leptomonas davidi* [see this *Review*, iii, p. 679]. There were no external symptoms of disease, but the latex was generally scanty, and the paucity of starch granules was also remarkable. A species of *Leptomonas*, apparently distinct from *L. davidi*, was found at the same time in the digestive tract of *Lygaeus saxatilis*.

GASCHEN (H. L.). **Contribution à l'étude de la flagelliase des Euphorbiacées en Suisse.** [Contribution to the study of the flagelliasis of Euphorbiaceae in Switzerland.]—*Mém. Soc. Vaud. Sci. Nat.*, II (5), 12, pp. 317–351, 2 figs., 5 graphs, 1 map, 1926.

Flagellosis of *Euphorbia gerardiana* and *E. cyparissias*, associated with infection by *Leptomonas davidi* [see preceding abstract], has been observed in 17 localities in the cantons of Valaïs and Vaud, Switzerland. The intermediate host of the flagellate in these regions is *Stenocephalus agilis*. Zotta's medium (250 gm. pulped calves' spleen, 1 to 2 gm. agar, 6 gm. per mille sodium chloride, and 250 to 500 c.c. tap water) was found suitable for the culture of *L. davidi*, of which the average duration of life was 15 days. Infected

plants exhibited marked pathological symptoms, the parasite attacking the stems, leaves, flowers, or fruit with equal virulence.

SHARPLES (A.). **'Sun-scorch' of exposed lateral roots of Hevea brasiliensis.**—*Malayan Agric. Journ.*, xiv, 5, pp. 116–118, 1926.

A brief account is given of an affection of exposed lateral roots of *Hevea brasiliensis*, which was first noticed in the spring of 1926 on a hilly estate in Malaya. On these roots slight cracks appeared in the bark which, on further examination, showed a much greater extension of apparently scorched and dead, dry bark than the cracks would indicate. The wood beneath the dead bark showed a greyish discoloration, which penetrated to about one inch in depth at the utmost but extended beyond the limits of the dead bark, indicating that the disease was progressing slowly along the wood, and not in the bark. Outwardly the symptoms suggested lightning or scorching injury. Isolations from the affected areas yielded the species of *Diplodia* [*Botryodiplodia theobromae*] which causes the die-back of branches of *Hevea*.

It was observed that in hilly divisions with an east and west frontage, no cases of the affection could be found on the east side, while on the west side the incidence was high, several trees in the same row being frequently affected. On isolated trees with several roots exposed around the trunk, those facing the west were heavily affected, while those facing the east were healthy or but slightly damaged. This evidence leads the author to the conclusion that the contributory cause of the trouble was the exposure of the trees on a slope facing west to the direct rays of a very hot afternoon sun during a period when the trees were leafless and shade was absent, owing to the exceptional conditions of 1926 in Malaya. This resulted in the scorched areas of the exposed roots being attacked by the fungus. A confirmation of this view was obtained by the reproduction of the symptoms by the author in inoculation experiments when the bark of exposed lateral roots was, previous to inoculation, scorched by fire.

The best form of treatment would be the excision of all the attacked wood and cortex, but as the lesions often attain considerable dimensions, occasionally reaching several feet in length, a better plan is to cut through the infected root in healthy tissue, removing the diseased root from the ground and burning it. Where wounds are small, the diseased tissue can be chiselled out; the exposed surfaces should be painted with a strong solution of solignum or jodelite, to be followed later by a generous application of tar.

STOUGHTON-HARRIS (R. H.). **The spraying of Rubber.**—*Bull. Rubber Growers' Assoc.*, viii, 7, pp. 333–337, 1926.

The present paper is an outcome of the author's trip to South India in the spring of 1926, on behalf of the Ceylon Rubber Research Scheme, made with a view to collecting information on the methods adopted there for the control of the secondary or *Phytophthora* leaf fall of *Hevea brasiliensis* [see this *Review*, v, p. 692]. It is a brief reproduction of Ashplant's reports on spray-

ing rubber trees, already noticed from other sources [ibid., v, pp. 53, 630]. Of interest is the parallel drawn between the conditions obtaining in South India and in Ceylon in regard to the leaf fall. It is pointed out that the intensity of attack in the former is far greater than in the latter, due to either or both of two main causes. In the first place the monsoon conditions are much more severe in South India than is generally the case in Ceylon, and in the second, leaf fall in the two countries is caused by two different species of *Phytophthora*, namely, *P. meadii* in South India, and *P. faberi* in Ceylon.

LINE (J.). **Aluminium and acid soils.**—*Journ. Agric. Sci.*, xvi, 3, pp. 335–364, 2 graphs, 1926.

The first section of the present paper deals with the changes brought about by the addition of aluminium salts to culture solutions and to soils, the outstanding feature of which is that the hydrogen-ion concentration of a culture solution containing an aluminium salt tends to remain more constant than that of a normal culture solution during the period of growth of the plant, when both start at the same P_H value. Aluminium salts also precipitate the soluble phosphate as aluminium phosphate, except in solutions or soils more acid than P_H 3·5 to 4·0, and this might lead to phosphate starvation in water cultures, but not in soils, where the particles of the phosphate would still remain accessible to the action of the plant roots.

In the second section the author criticizes the experimental evidence brought forward by other workers in support of the 'toxic aluminium' theory, including the injection experiments of Hoffer and Carr [see this *Review*, iii, p. 32; v. p. 326]. The harmful effect observed on the tissues following the injection of pure solutions of aluminium salts into the stems of maize was scarcely apparent at all when a mixture of an aluminium salt and calcium nitrate was injected. These investigators also found that more aluminium was present in the ash of plants affected with stem rots, and considered that the incidence of these rots was correlated with the aluminium present in the soil; it might, however, surely be argued that the action of a parasitic organism, or the acidity of the soil, had affected the permeability of the plant root membranes and thus allowed the increased absorption of aluminium. He then goes on to describe his own pot culture experiments in 1923–5, which lead him to the conclusion that the 'toxic aluminium' theory is no longer tenable. Aluminium is precipitated from solution of its salts as hydroxide when the reaction of the soil approaches P_H 4·0 and as phosphate between P_H 3·0 and 4·0, so that it would appear impossible for aluminium to exist as a soluble salt even in very acid soils. The small amounts of aluminium present in acid soils as hydrosol do not appear to have any toxic effect on any of the plants tested, nor was this amount found to be related to the fertility of the soil. On the other hand, the addition of aluminium salts to acid soils may considerably increase the acidity. Depression in plant growth ensues when a hydrogen-ion concentration injurious to the particular plant is reached and maintained throughout the growing period. Lime and phosphatic dressings are beneficial

solely in that they reduce the acidity of the soil or supply plant nutrients, but not by their supposed precipitating action of the soluble aluminium.

WAKSMAN (S. A.) & SKINNER (C. E.). **Microorganisms concerned in the decomposition of celluloses in the soil.**—*Journ. of Bact.*, xii, 1, pp. 57–84, 1926.

Fungi and aerobic and anaerobic bacteria have been found to be the most important agents concerned in the decomposition of celluloses in the soil [see this *Review*, v, p. 317]. Under aerobic conditions a much larger amount of nitrogen is required for the decomposition of cellulose in the soil than under anaerobic; this is due to the much smaller output and utilization of energy by anaerobic organisms. Aerobic decomposition of cellulose begins very early in the presence of available nitrogen, while anaerobic decomposition sets in late, indicating that, in normal soils, organisms capable of decomposing cellulose under anaerobic conditions do not occur in great abundance. The addition of 1 per cent. cellulose or straw to soils kept under aerobic conditions, especially in the presence of available nitrogen, causes a very large increase in the number and development of filamentous fungi, e.g., species of *Fusarium*, *Trichoderma*, *Penicillium*, and various Dematiaceae, as determined by plate counts and direct microscopic examination.

A direct correlation was found between cellulose decomposition, development of fungi, and transformation of soluble nitrogen into microbial protoplasm.

The elimination of fungi from the soil by treatment with volatile antiseptics [ibid., iii, p. 362] prevents cellulose decomposition in normal soils under aerobic conditions; reinoculation of the partially sterilized soil results in an extensive development of fungi and rapid cellulose decomposition.

Under anaerobic conditions in normal soil, straw heaps, and manure piles, the decomposition of cellulose is exclusively performed by bacteria. Aerobic bacteria are also capable of decomposing cellulose in certain soils (alkaline and arid) and may play an important part in this process in such conditions.

Some actinomycetes are capable of decomposing cellulose, but they do not appear to participate directly in the operation in the soil itself; their action is largely confined to the secondary products, either liberated or synthesized by the other organisms, and to some constituents of natural organic substances.

The rôle of nitrogen in limiting the decomposition of cellulose in the soil shows that nitrogen-fixing bacteria probably do not increase the store of soil nitrogen under aerobic conditions, especially in humid soils, when cellulose or straw are added as sources of energy. Nitrogen fixation occurs, however, with the introduction of starches and lower carbohydrates.

The results of these investigations lead to the conclusion that, under aerobic conditions and in damp soils, fungi are largely concerned in the decomposition of celluloses, while in arid and alkaline soils, aerobic bacteria seem to play an important part in the process. This description of the relations between fungi and bacteria is

thought to be probably applicable to the decomposition of cellulose not only in the soil, but under all natural conditions.

The literature on cellulose decomposition is briefly reviewed and a bibliography of over 80 titles is appended.

YODER (P. A.). **Rare cases of mosaic disease in highly resistant varieties of Sugar Cane.**—*U.S. Dept. of Agric. Circ.* 392, 7 pp., 1926.

Up to 1924, rare cases of mosaic disease were observed on certain well-known varieties of sugar-cane of the slender, fibrous, prolific, Chinese type (in which are included Uba, Cayana, Kavangire, and various Japanese and north Indian canes), which are usually regarded as practically immune. The varieties occasionally affected included Kikaigashima, Oshima, Yontanzan, Chikucha, Chikusho (Tekcha), and Kagawa Ken of Japanese origin, and the Indian Khera.

In the autumn of 1924, the writer observed a case of mosaic in the Uba variety at Cairo, Georgia, and a systematic search made during the following summer revealed the existence of the disease in all the occasionally affected varieties mentioned above, as well as in three other representatives of the Chinese group, namely, Cayana, Kavangire, and Old Small Japanese.

Owing to the slightness of infection and the lack of serious stunting on these varieties, they may still be classed as immune in regard to yield, but their susceptibility must be taken into consideration in the distribution of material to non-infected localities and in schemes for the total elimination of mosaic from a given area by the use of selected seed. Roguing should prove effective in the eradication of infection from these varieties.

[This paper appeared also in the *Intern. Sugar Journ.*, xxviii, 332, pp. 411–417, 1926.]

Eradication of mosaic.—*South African Sugar Journ.*, x, 7, pp. 401–402, 1926.

For some time past a deadlock has existed in South Africa with regard to the eradication of mosaic disease of sugar-cane [see this *Review*, iv, p. 123], owing to the fact that neither the Government nor the industry would assume the financial burdens entailed by the payment of compensation. At the recent Sugar Congress [April, 1926] a resolution was passed urging the South African Sugar Association to take immediate steps to settle the question. Investigations are said to have shown that the industry is quite capable of meeting the comparatively small outlay involved in compensation, and it has already been ascertained that the Zululand planters are willing to supply the necessary funds if supported by the Natal cane growers.

UNITE (J. O.) & CAPINPIN (J. M.). **Selection of mosaic free cuttings of Sugar Cane.**—*Philipp. Agric.*, xv, 2, pp. 67–73, 1926.

The present paper is a report of several experiments on the selection of mosaic-free cuttings of sugar-cane conducted at the

Los Baños College of Agriculture, Philippine Islands, from 1923 to 1925 [see this *Review*, iv, p. 469].

Four clones of first generation plant canes of Luzon White, cut from parents showing no symptoms of mosaic in a heavily infected field, were free from mosaic when reaped at 16·5 months and the ratoons were also free at 7 months. In 1925, cuttings from these were planted alternately with diseased cuttings of D 1135. On 29th July the incidence of mosaic in the four clones of second generation plants varied from 0·0 to 6·7 per cent., while the D 1135 showed 50 to 94 per cent. infection; on 4th September the amounts of infection were 30 to 44 per cent. and 50 to 94 per cent., respectively, indicating that the freedom of the parents from mosaic was not due to appreciable resistance. Healthy and diseased top and stalk cuttings of P.B. 117, a seedling of Badila, were taken from an infected field and planted in rows; when inspected most of the rows from the healthy cuttings showed 0·0 to 1·5 per cent. mosaic, while the rows planted with diseased cuttings varied in infection from 27·4 to 97·6 per cent. These observations with Luzon White and P.B. 117 indicate that the laborious practice of selection is of some value in reducing the incidence of field infection. The observation was also made that buds on infected stalks invariably produce mosaic shoots irrespective of whether the subtending leaves show symptoms or not.

BREMER (G.). **Een cytologisch onderzoek van strepenziekte bij Zuikerriet en andere planten.** [A cytological study of stripe disease in Sugar-cane and other plants.]—*Meded. Proefstat. Java Suikerind.*, 11, pp. 337–371, 20 figs., 1926.

The writer made a cytological investigation [technical details of which are given] of mosaic and healthy plants of sugar-cane, maize, sorghum, *Andropogon halepensis*, *Hippeastrum equestre*, and *Eucharis amazonica*.

Intracellular bodies, generally containing several vacuoles surrounded by a dense protoplasm, were found in all the diseased plants. The bodies varied considerably in shape from spherical to oval or amoeboid, though no evidence of independent motion was obtained. They were generally single and situated close to the cell nucleus. The bodies themselves were devoid of nuclei and were not surrounded by a wall. In *H. equestre* and *E. amazonica* the bodies were consistently larger than in sugar-cane, maize, and sorghum.

The intracellular bodies were present in nearly all the cells in the pale green portions of the diseased *Hippeastrum* leaves, these cells having small chlorophyll corpuscles. In cells in which the latter were of normal size the bodies were absent. In *Eucharis*, maize, and sorghum they were sometimes altogether absent and sometimes occurred in profusion, especially in the epidermal cells. In sugar-cane the bodies were found only in mosaic leaves of E K 44 and Hawaii 211. Thus the presence of intracellular bodies in mosaic plants is a very variable feature of the disease.

As a rule these bodies were entirely absent from healthy plants, though small ones were occasionally found in apparently normal *Hippeastrum*. Probably, however, these plants were really in an

incipient stage of mosaic, and intracellular bodies, when present, may be definitely regarded as evidence of the disease. Striate material [see this *Review*, iv, p. 363] was also found in the epidermal cells of diseased *Hippeastrum* plants.

The work of other investigators in this field is briefly reviewed and the various theories concerning the rôle of the bodies in the etiology of mosaic are discussed. The writer regards them, not as parasitic in themselves, but merely the product of reaction of the cell to the infective principle.

DAVIS (J. J.). **Notes on parasitic fungi in Wisconsin. XII-XIII-XIV.**—*Trans. Wisconsin Acad. Sci., Arts and Lett.*, xxii, pp. 155–192, 1 fig., 1926.

Continuing his series of notes on Wisconsin fungi [see this *Review*, iv, p. 130] the author discusses species belonging to the Fungi Imperfecti, Uredinaceae, and Ustilaginaceae, including some new species, English diagnoses of which are given.

JACKSON (H. S.). **The rusts of South America based on the Holway collections—1.**—*Mycologia*, xviii, 4, pp. 139–162, 1 pl., 1926.

Professor J. C. Arthur has recently given an account of the grass rusts of South America collected by the Holways [see this *Review*, v, p. 252], and the author is continuing this by enumerating those of other plants in the same collections.

In the present paper a number of new species are described on monocotyledonous hosts (excluding grasses), on which 49 species in all are enumerated.

HANSFORD (C. G.). **The Fusaria of Jamaica.**—*Kew Bull. Misc. Inform., 1926*, 7, pp. 257–288, 1926.

In connexion with experimental work on the Panama disease of banana (*Musa sapientum*) the author studied in pure culture a large number of species of *Fusarium* isolated from numerous soil samples and from specimens of living and decaying plants collected from time to time in Jamaica. With the exception of the *Fusarium* causing Panama disease (*F. cubense* E. F. Smith emend. Brandes), the species enumerated in the present paper were studied only from a purely morphological standpoint; their classification is based on the work of Wollenweber and his co-workers [see this *Review*, iv, pp. 569, 705].

Descriptions [and in most cases technical diagnoses] are given of 26 species and varieties belonging to various sections, not counting the section *Elegans* which is separately dealt with and to which special attention was given in the course of the present work. Of the 318 strains belonging to this section, 103 were isolated from the vascular tissues of banana plants affected with the Panama disease and the rest were obtained from soil and other sources. A careful study of the morphological characters of single-spore strains confirmed the author in his opinion [ibid., v, p. 111] that the entire *Elegans* section is but a single morphological species. The strains of this species that he studied may be divided into ten groups [a detailed description of which is given]. Of these groups five,

comprising 103 strains, were shown by inoculation experiments to be pathogenic to the banana. Four more, covering 202 strains, were each morphologically indistinguishable from one or other of the parasitic groups, but were incapable of attacking the banana; while the last group of 13 isolations was morphologically different in size and shape of the conidia, but otherwise similar to one of the other groups in both the parasitic and saprophytic sections. The boundaries of these groups are not sharply delimited, but each represents a type, and in each group are included strains that diverge from this type to a greater or lesser extent. Especially is this the case in those groups separated on a basis of the size of the conidia.

In no case was a pathogenic strain isolated from any soil other than that in which bananas suffering from Panama disease were grown, and all the evidence up to date indicates that such strains are absent from virgin soils or healthy banana soils [ibid., v, p. 617]. The author concludes from the results of his work that the only possible way of recognizing the pathogenic organism, *F. cubense*, from the saprophytic strains is that of inoculation into healthy banana plants, in other words, that *F. cubense* is a purely 'biological' species and cannot be diagnosed from its morphological characters in artificial culture. He, therefore, prefers to class all the organisms he has isolated belonging to this section of the genus as strains of *F. oxysporum*, the latter being the earliest name in the section *Elegans* fitting some of the strains he has encountered. A list is also given of the various other 'species' of this section as recognized by Wollenweber, which have been found by the author in Jamaican soils or on decaying vegetable matter and included in the groups mentioned above. These included such forms as *F. orthoceras*, *F. asclerotium*, *F. lycopersici*, and *F. aurantiacum*.

The author's work has definitely confirmed that of earlier investigators in establishing that *F. cubense* is the only parasite concerned in the early stages of Panama disease, no evidence whatever in favour of Gäumann's views to the contrary [ibid., i, p. 225] being obtained.

In the section *Martiella* also, the species recognized by Wollenweber and Sherbakoff are not, in many cases, based on characters which the author regards as sufficiently stable for the purpose. In his isolations he has found several which form intermediate links between two or more species, and he is of opinion that future workers will find it advisable to merge such cases into single, more comprehensive species.

Butler (E. J.). **The wilt diseases of Cotton and Sesamum in India.**—*Agric. Journ. of India*, xxi, 4, pp. 268–273, 1 pl., 1926.

The purpose of the present paper is to describe some unpublished work on the wilt diseases of cotton and sesame (*Sesamum indicum*) carried out by the author in 1912 at Pusa, India.

A detailed description is given of artificial inoculations of seedlings of both hosts with the organisms isolated from wilted plants, the results of which, together with the morphological and cultural features of the pathogens, lead the author to consider that the wilt-

producing fungi attacking cotton, sesame, and pigeon pea [*Cajanus indicus*] in India are specialized strains of *Fusarium vasinfectum*, the American cotton wilt organism. A comparison of these strains with *F. cubense*, causing the Panama disease of bananas, revealed no constant morphological or cultural differences, and further leads him to be in sympathy with Hansford's view that it is preferable to regard all the forms of the *Elegans* section of the genus as strains of a single species [see preceding abstract].

With special regard to the strain causing the wilt of cotton it is believed, from the results of the inoculation experiments, that the organism is capable of definitely pathogenic action under certain conditions not yet elucidated, and that these conditions are probably not connected with the composition of the soil, as has been suggested by Dastur [see this *Review*, v, p. 489].

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, 7, 1926.

Costa Rica. By a Decree, No. 2 of 16th January, 1925, it is prescribed that, as from 22nd January, 1925, permits must be obtained for the import into Costa Rica of all plants, seeds, roots, and bulbs required for planting.

Switzerland. A Decree effective from 1st June, 1926, which supersedes those of 6th and 20th October and 6th November, 1925 [see this *Review*, v, p. 191], contains various modifications in the original draft of the provisions for the control of wart disease of potatoes [*Synchytrium endobioticum*]. Austria and the Department of Bas-Rhin (France) are added to the localities from which certificates are required with potato consignments.

Württemberg. As from 31st December, 1925, special regulations for the control of wart disease of potatoes [*Synchytrium endobioticum*] came into force in Württemberg. Provision is made for the official inspection of fields, gardens, and stocks; for the notification of infection; and for the control of the disease by the disposal of the crop so that strict precautions are taken against the spread of the disease by the transport or use of diseased material, the destruction by burning of all remnants of the crop on infected land, and the planting only of certified immune varieties in infected or suspected areas.

Bremen. A regulation of 23rd January, 1926 (published in the Bremen daily papers on the 24th), designed to prevent the spread of potato wart [*Synchytrium endobioticum*], provides for the establishment of a 'suspected area' (comprising the Bremen urban district and all allotments in the Bremen rural district), within which only immune varieties [a list of which is given] may be cultivated. These varieties are obtainable solely from chambers of agriculture or certain other [specified] bodies and from certain dealers having a written permit from the proper authorities.

INDEX OF AUTHORS

GENERAL INDEX

PRINTED IN ENGLAND AT THE
UNIVERSITY PRESS, OXFORD
BY JOHN JOHNSON
PRINTER TO THE UNIVERSITY